WORK PLAN

ALLIED-SIGNAL UOP SITE

EAST RUTHERFORD, NEW JERSEY

SEPTEMBER 1986

Geraghty & Miller, Inc.,
Ground-Water Consultants
125 East Bethpage Rd.
Plainview, New York 11803

ERT
A Resource Engineering Company
696 Virginia Road
Concord, Massachusetts 01742

CONTENTS

TABLES

APPENDICES

WORK PLAN

ALLIED-SIGNAL UOP SITE

EAST RUTHERFORD, NEW JERSEY

INTRODUCTION

This document provides the details of work to be performed at the Allied-Signal UOP site in East Rutherford, New Jersey. The work is a follow-up to the tasks performed as part of the Phase II investigation, the results of which are included in the May 1985 Phase II report.

For purposes of discussion, the site has been divided into six areas as shown on Figure 1. Areas 1, 1A, and 5 are contiguous, so they are considered together. The physical characteristics of the areas vary and so do the Work Plan elements for each. The following summary lists the predominant activities:

Areas 1, 1A, and 5:	Follow-up soil investigation (Area 1); soil and ground-water investigation (Area 1A); magnetometer survey; test pits, soil borings, and well points (Area 5); feasibility study; remedial action.
Area 2:	(Formerly referred to as Areas 2 and 6): Follow-up soil investigation; feasibility study; remedial action.
Area 3:	Remedial action for waste-water lagoons.

Area 4: Follow-up sediment investigation; feasibility study; remedial action.

The appendices include information that is common to much or all of the Work Plan including:

1. Well installation and sampling methodologies, including field QA/QC protocols

2. Health and safety plan

3. Reporting requirements

All sampling required as part of field program will follow the NJDEP Field Sampling Procedures Manual (November 1985).

As segments of the work are completed, specific completion reports will be prepared and submitted to the New Jersey Department of Environmental Protection (NJDEP). The reports to be submitted along with the work schedule are shown in Table 1.

AREAS 1, 1A, AND 5

Although the work to be performed in these three areas differs from area to area, they are grouped together because they are contiguous. A separate Investigation Work Plan is provided to each area below, but one Investigation Report, one Feasibility Study Work Plan, one Feasibility Study, and one Remedial Action Work Plan will be developed covering all three areas. These studies and reports will be prepared according to guidance referenced or included in Appendix F and will be submitted according to the schedule in Table 1. Remedial actions as required will follow final approval of the Remedial Action Work Plan.

Area 1

Introduction for Area 1

Area 1 has been studied during both the Phase I and Phase II investigations at the UOP site, and it appears that ground-water contamination is the area's predominant characteristic. In order to determine whether a substantial amount of contamination exists in the soils, which would be indicative of a discrete source area, nine borings will be drilled and the soils at these locations analyzed.

Work Plan for Area 1

Nine shallow borings will be drilled at the locations (subject to field conditions) shown in Figure 1. These locations along with those sampled during the earlier field work provide coverage (density and distribution) that is in accord with NJDEP guidelines. One sample will be collected from the unsaturated zone (0-2 ft below land surface, excluding demolition debris), and one from the saturated zone (first two feet below the water table, including the capillary zone) at each boring location. If the unsaturated zone is less than one foot thick, only the saturated sample will be taken. The analytical schedule is listed in Table 2. Appendix A contains protocols for soil sampling and details of field instrument operation, and Appendix B includes the health and safety plan.

Area 1A

Introduction for Area 1A

Relatively less is known about Area 1A than about Area 1 where more wells and borings have been drilled. The additional investigative work proposed for Area 1A includes both borings to determine soil quality and wells to refine ground-water flow characteristics and to measure ground-water quality.

Work Plan for Area 1A

Eight borings will be drilled at locations (subject to field conditions) shown in Figure 1 and soils sampled as described in the Work Plan for Area 1. The number and locations of borings provide the coverage indicated in NJDEP guidance. Two of the borings will be converted into ground-water monitoring wells. Protocols for well installation and soil sampling appear in Appendix A and procedures for collection of ground-water samples appear in Appendix D.

The soil samples and ground water will be analyzed for priority pollutant organic and inorganic constituents as indicated in Table 2.

Area 5

Introduction for Area 5

Although ground-water data from several wells in Area 5 do not indicate substantial contamination, the area will be investigated to characterize past disposal area(s). The Work Plan for this area consists of several phased tasks including a magnetometer survey, test pits, borings, and well points.

Work Plan for Area 5

In order to determine whether buried metal is present, a magnetometer survey has been conducted in the area. Procedures and a description of the method are included in Appendix E.

The results of the magnetometer survey were evaluated and a Magnetometer Report sent to the NJDEP on July 23, 1986. This report includes a proposal for test-pit installations to explore magnetic anomalies. Results of the test-pit program will guide the installation of soil borings and well points. Protocols for installation of soil borings and well points is included in Appendix A. Borings will be drilled at a density of one per acre in areas not considered to be contaminated and four per acre in areas considered to be contaminated. Soils will be sampled as described in the Work Plan for Area 1.

AREA 2

Introduction

Area 2 has been studied during the Phase I and Phase II investigations and ground-water contamination underlies part of the area. Soil samples are to be collected and analyzed to determine if substantial contamination, indicative of a discrete source, exists in the soil.

Workplan

Ten shallow borings will be installed at the locations (subject to field conditions) shown on Figure 1. One soil sample each from the unsaturated and saturated zones will be collected as described in the Work Plan for Area 1 and sent to an approved laboratory for the analyses listed in Table 2.

In accordance with the schedule in Table 1, a Feasibility Study Work Plan will be prepared for Area 2, to be followed by the Feasibility Study, Remedial Action Work Plan, and remedial actions, as required. Studies and reports will be prepared according to guidance referenced or included in Appendix F.

AREA 3

Introduction

The quality of sludges in the two waste-water lagoons and their extent are described in the Phase II report. UOP has notified the NJDEP that it intends to excavate and remove the sludge. A Remedial Action Work Plan will be prepared and submitted according to the schedule included in this Work Plan.

The Remedial Action Work Plan for Area 3 shall address the following:

a. Measures to prevent the discharge of pollutants into the stream during the excavation of the sludge shall be detailed.

b. A comparison shall be made between the use of a suction dredge or vacuum pump (Supervac) versus the practice of using a clam bucket to dredge the lagoon. The objective shall be to prevent the flow of materials to the stream.

c. The method of transport of this material shall be specified (e.g. tankers, trucks).

d. In-situ stabilization of the material prior to excavation (e.g. mixing kiln dust or other materials to solidify the sludge) shall be evaluated.

e. If temporary sludge storage is needed on-site, the following items shall be evaluated:

   (1) location of stock pile;

   (2) pile storage (e.g. type of liner, type of containment, etc.);

   (3) methods of dewatering, collection and treatment of leachate from the sludge pile;

(4) discharge of water associated with this system.

f. The treatment and discharge of any dewatered product as the result of excavation and/or solidification of the sludge shall be evaluated.

g. The necessary permits shall be specified. (e.g. stream encroachments, etc.)

h. Post excavation sampling procedures shall be detailed.

i. UOP shall clarify whether off-site disposal means landfilling without treatment or off-site treatment prior to landfilling.

Upon NJDEP review and approval of the RA Work Plan for Area 3, the remedial activities described therein will be performed according to the schedule included in the RA Work Plan.

AREA 4

Introduction

Area 4 comprises the surface-water channels that pass through the UOP property as shown on Figure 1 and extends to Berry's Creek. Offsite portions of Area 4 are also shown on Figure 1. Preliminary data show that polychlorinated biphenyls (PCBs) are present in certain onsite areas. The field work to be performed is designed to delineate the extent of PCB contamination in greater detail. As further indicated below, certain laboratory samples will also be analyzed for dichlorobenzenes, chromium, and mercury.

In order to determine the volume of sediments with PCBs, transects across the stream channels will be established at several of the sampling locations. Samples will be taken at different locations and depths along the transects. The distance between sampling locations will be determined in the field; a nominal 250 ft spacing will be applied at the outset. This density results in approximately 20 sampling locations for the onsite channels. At approximately eight of these locations, transects will be established across the stream. At the remaining 12 locations, one surficial sample will be taken to further delineate the longitudinal extent of contamination.

Two transects, three points each, will be established in Berry's Creek - one 250 ft north and one 250 ft south of the confluence of Ackerman's Creek with Berry's Creek. The sediment sampling protocol is included in Appendix D.

Samples for PCBs will be screened in the field using a McGraw-Edison field instrument (see Appendix A). The field results will be confirmed by laboratory analysis as outlined below.

Sediment samples from Ackerman's Creek and its tributaries that are sent to the laboratory will be analyzed for PCBs, mercury, and total chromium.

Sediment samples from the "north ditch" portion of Area 4 and from Berry's Creek will be further analyzed for dichlorobenzenes. All samples from the "north ditch" and Berry's Creek will be analyzed in the laboratory.

When the field and confirming laboratory work is complete, an Investigation Report and Feasibility Study Work Plan will be prepared. This report will be followed, as appropriate, by a Feasibility Study and a Remedial Action Work Plan. The schedule for this work is included in Table 1. The studies and reports will be prepared according to guidance referenced or included in Appendix F.

OTHER ITEMS

Introduction

Other tests and studies not specific to the areas enumerated above are included here.

Work Plan

A yellow or green floc at a surface-water location has been observed and photographed by the the NJDEP. If a sample can be obtained, it will be analyzed for organic and inorganic priority pollutants.

To the extent possible, onsite production wells will be located, inspected, and construction details obtained. If the wells can be sampled, water samples will be obtained and analyzed for Priority Pollutants +40. Based on the well construction information, a plan for closure for each well will be established and submitted to NJDEP for review as per the schedule in Table 1.

Also included with the production well closure plan will be data from the deep monitoring Wells 3D and 7D. A schedule for sealing Wells 3D and 7D cannot be provided at this time because it is not now known when their usefulness as monitoring points will cease. UOP will be in contact

with the NJDEP on this issue and will develop a sealing schedule when the necessary information is available.

Unless extraordinary measures are required, a two-well cluster will be installed at the junction of Murray Hill Parkway and Ackerman's Creek and a third well will be installed further west and at a mutually agreeable location. Ground water from these wells will be analyzed for organic and inorganic priority pollutants. Table 1 includes the schedule of activities associated with these new wells.

After installation of the new wells is completed, water levels will be measured in all wells (new and existing) on two occasions at least 30 days apart. Water-table maps will be prepared for each round of data and submitted as part of the report indicated in the schedule (Table 1).

Pumping or slug tests shall be performed in six monitoring wells to be selected by the NJDEP and UOP from existing and proposed wells. The test results shall be interpreted to provide information on the hydrologic characteristics of the monitored formation.

Geraghty & Miller, Inc. has provided the NJDEP with ground-water contour maps taken at high and low tide. If this information is not sufficient, the NJDEP and UOP shall

jointly design an additional monitoring experiment that will address the unresolved issues.

Subject to obtaining access, sediments underlying surface water to the south of UOP property (designated "offsite surface water" and shown on Figure 1) will be sampled in a manner similar to that for Area 4. At approximately seven locations (nominal 250 ft spacing), transects will be constructed and soil samples will be analyzed in the field of PCBs. Sampling protocols are included in Appendix D and specifications of the field instrumentation are included in Appendix A. The field results will be confirmed by laboratory analysis as described below. The results of this offsite investigation, if performed, will be included in the reports for Area 4.

CHEMICAL ANALYSIS

Chemical analyses will be performed by a laboratory on the list entitled "New Jersey Department of Environmental Protection Approved Laboratories (Listed Alphabetically) Required for EPA-CLP Level Work" or successor lists. The May 1986 version of this list is included in Appendix D.

GC/MS instrumentation will be used, as appropriate for the analysis of samples where all priority pollutants are specified. GC may be used for two types of samples:

1. where PCB analysis is required. PCBs are not normally analyzed by GC/MS, even when the GC/MS analyses for other priority pollutants are specified.
2. where analysis for VOCs plus dichlorobenzenes is required.

The GC analysis for VOCs and dichlorobenzenes using EPA Methods 601 and 602 or equivalent provides accurate and precise results combined with low detection limits and may be used in place of EPA method 624 depending on laboratory scheduling. EPA method 602 is the method of choice for dichlorobenzenes as documented by EPA Interlaboratory Method Validation Studies (Federal Register, October 26, 1984, pages 43,234 to 43,442). For example, at 20 ug/L, the following results summarize the data for the dichlorobenzenes:

Method	Measured Concentration[a] 1,2 DCB	1,3 DCB	1,4 DCB
602 GC	19.1 ± 3.2[b]	19.2 ± 2.8	18.7 ± 3.1[b]
624 GC/MS Volatiles	23.3 ± 3.6[b]	22.9 ± 2.7	23.3 + 3.6[b]
625 GC/MS Extractables	16.3 ± 3.7	16.5 ± 4.8	13.1 ± 3.4

[a]Nominal concentration: 20 ug/L
[b]Unresolved

Aside from the suitable performance of GC as indicated, GC is appropriate in this third phase of investigation of the UOP site, because the prominent compounds are known. Post-cleanup sampling will be done by GC/MS with 20% Tier I deliverables.

PCB Verification

Prior to commencing the field program, a pilot study will be conducted to determine the accuracy and efficiency of the McGraw-Edison PCB field test kit. The pilot study will entail a comparison of field test kit and laboratory analysis of at least 20 sediment samples covering a broad range of concentrations. Graphical analysis will be completed to develop a "calibration curve" showing the relationship between field test kit results and lab analytical results. Results will be submitted to the NJDEP for approval prior to implementation of the field testing. If it is determined that field PCB detection limits can be lowered by drying the samples, provisions will be made for field drying.

Ten percent of those samples exhibiting detectable PCB levels by field measurement will be submitted to the laboratory for confirmation of PCB content. All samples showing no detectable PCB levels by field measurement will be submitted to the laboratory for PCB analysis.

Tier I/Tier II protocols

Several portions of the site (Areas 1, 2, 3, and 4) have been investigated in detail and Tier I analyses will provide little, if any additional information or data surety. For samples from these areas, 20% will be analyzed according to Tier I protocols and 80% according to Tier II protocols. Relatively less is known about Areas 1A and 5; all samples from Areas 1A and 5 will be analyzed according to Tier I protocols.

PROJECT SCHEDULE

Table 1 provides a schedule for all activities, including reporting. Every effort will be made to adhere to this schedule. The NJDEP will be informed of any notable changes and will be provided with relevant reasons for any necessary modifications. Appropriate NJDEP personnel will be notified in advance of field work so that field audits may be performed.

PROJECT PERSONNEL

The Geraghty & Miller, Inc. Senior Staff includes David W. Miller, principal with overall project responsibility, Michael F. Wolfert, project officer and hydrogeologist, and Robert A. Saar, Ph.D., project manager and geochemist. The ERT senior staff includes William A. Duvel, Jr. Ph.D., P.E., the project officer, and Michael Worthy, P.E., project manager and engineer. Resumes for these supervisory personnel are included in Appendix G.

Respectfully submitted,

GERAGHTY & MILLER, INC.

Robert A. Saar

Robert A. Saar, Ph.D.
Senior Scientist

Michael F. Wolfert

Michael F. Wolfert
Associate

September 5, 1986

Geraghty & Miller, Inc.

Table 1. Work Plan Schedule, Allied-Signal UOP Site, East Rutherford, New Jersey

	Period of Performance[a]	Code[a]
Areas 1, 1A, and 5		
Borings and laboratory analyses for Area 1	15-100	B
Borings, wells, and laboratory analyses for Area 1A	25-110	B
Magnetometer Survey for Area 5 and eastern part of Area 1A	March 1986	-
Submittal of Magnetometer Report	July 1986	-
Test pits, borings, wells and laboratory analyses for Area 5	35-140	B
Preparation and submittal of Investigation Report and Feasibility Study Work Plan for Areas 1, 1A, and 5	0-75	C
Modify Investigation Report and FS Work Plan and submit revised document for Areas 1, 1A and 5	0-20	A
Conduct FS and submit FS Report for Areas 1, 1A and 5	b	-
Modify FS Report and submit Revised FS Report for Areas 1, 1A and 5	0-20	A
Preparation and submittal of draft Remedial Action Work Plan for Areas 1, 1A, and 5	0-45	D
Modify Remedial Action Work Plan and submit revised Remedial Action Work Plan for Areas 1, 1A, and 5	0-20	A
Implement Remedial Action Work Plan for Areas 1, 1A and 5	b	-
Areas 2, 4, and Offsite Surface-Water Sediment Investigations		
Borings and laboratory analyses for Area 2	15-90	B

Table 1. Work Plan Schedule, Allied-Signal UOP Site, East Rutherford, New Jersey

	Period of Performance[a]	Code[a]
Field investigation and laboratory for Area 4 (including North Ditch)	15-115	B
Field Investigation and laboratory for offsite surface-water sediments	25-130	B
Preparation and submittal of Investigation Report and FS Work Plan for Areas 2, 4, and Offsite surface-water sediments investigations	0-75	C
Modify Investigations Report and FS Work Plan and submit revised document	0-20	A
Conduct FS and submit FS Report for Areas 2, 4, and offsite surface-water sediments	b	-
Modify FS Report and submit Revised FS Report for Areas 2, 4, and offsite surface-water sediments	0-20	A
Preparation and submittal of draft Remedial Action Work Plan for Areas 2, 4, and offsite surface-water sediments	0-45	D
Modify Remedial Action Work Plan and submit revised Remedial Action Work Plan for Areas 2, 4, and offsite surface-water sediments	0-20	A
Implement Remedial Action Work Plan for Areas 2, 4, and offsite surface-water sediments	b	-
Area 3		
Preparation and submittal of Remedial Action Work Plan for Area 3	0-45	D
Modify Remedial Action Work Plan and submit revised Remedial Action Work Plan for Area 3	0-20	A

Table 1. Work Plan Schedule, Allied-Signal UOP Site, East Rutherford, New Jersey

	Period of Performance[a]	Code[a]
Implement Remedial Action Work Plan for Area 3	b	-
Other Items		
Green Floc and Production Wells		
Sampling (if present) and analysis of green floc	15-65	B
Locate and provide construction details of production wells	55-85	B
Prepare and submit Green Floc and Production Well Report with data and recommendations for production wells	85-105	B
Modify Green Floc and Production Well Report and submit revised Report	0-20	A
Implement approved course of action	b	-
Additional Monitoring Wells		
Well installation, sampling, water levels, laboratory analysis	25-130	B
Hydrogeologic and Chemical Data Report including results and interpretation	0-30	C

Notes

[a] The time point of reference is denoted by the following codes:

Code A Calendar days following receipt of written comments from the NJDEP

Code B Calendar days following receipt of final written approval of applicable workplan or report

Code C Calendar days following receipt of all written relevant laboratory and field data.

Table 1. Work Plan Schedule, Allied-Signal UOP Site, East Rutherford, New Jersey

Code D Calendar days following receipt of NJDEP written notification of selection of remedial action alternative.

b To commence within 20 days of final written approval of applicable report or workplan and to be performed following the schedule specified in the report or workplan.

Table 2. Soil analyses, UOP Site, East Rutherford, New Jersey

	Dichloro-benzenes	PCBs	Cr	Pb	Zn	Hg	VOCs	Organic Priority Pollutants +40 and 8 inorganics*
Area 1								
B1-1	X	X	X				X	
B1-2	X	X	X				X	
B1-3	X		X				X	
B1-4	X		X				X	
B1-5	X		X				X	
B1-6	X		X				X	
B1-7	X		X				X	
B1-8	X		X	X			X	
B1-9	X		X	X			X	
Area 1A								
B1A-1								X
B1A-2								X
B1A-3								X
B1A-4								X
B1A-5								X
B1A-6								X
Well 27 soils and ground water								X
Well 28 soils and ground water								X
Area 2								
B2-1		X					X	
B2-2		X					X	
B2-3		X					X	
B2-4		X	X				X	
B2-5		X	X			X	X	
B2-6		X				X	X	
B2-7		X	X			X	X	
B2-8		X				X	X	
B2-g		X			X		X	
B2-10		X			X		X	

Table 2. Soil analyses, UOP Site, East Rutherford, New Jersey

	Dichloro-benzenes	PCBs	Cr	Pb	Zn	Hg	VOCs	Organic Priority Pollutants +40 and 8 inorganics*
Area 4								
Onsite channel sediments		X	X			X		
Northern Ditch	X	X	X			X		
Berry's Creek	X	X	X			X		
Area 5								
B5-1 to							X	
B5-7							X	
Other Items								
Offsite sediments	X	X	X			X		

* Cyanide, lead, chromium, cadmium, mercury, arsenic, zinc, and maganese.

APPENDIX A

DRILLING, SOIL SAMPLING, WELL INSTALLATION, WATER-LEVEL MEASUREMENTS, AND SURVEYING

FIELD INSTRUMENTATION: INFORMATION AND PROTOCOLS

APPENDIX A

DRILLING, SOIL SAMPLING, WELL INSTALLATION, WATER-LEVEL MEASUREMENTS, AND SURVEYING

Drilling and Soil Sampling

All wells and soil borings will be drilled under the direct supervision of a New Jersey licensed well driller.

A truck- or tract-mounted hollow-stem power auger will be used to drill all boreholes for either well installation or soil sampling purposes. This technique is relatively fast, and the drilling rig is small and mobile. One of the major advantages of this drilling technique in contamination investigations is that water does not have to be added during the drilling.

For single wells and for the deepest well in well clusters, split-spoon soil samples will be collected from land surface continuously to two feet below the water table. The boreholes drilled for well installation will extend approximately 15 feet below the water table. In these deeper boreholes the split-spoon samples will be collected every five feet for the full hole depth.

The drill rig and tools will be decontaminated by steam cleaning before the start of work and again before the rig leaves the site at the completion of the work. The auger flytes of the drilling rig will be steam cleaned between each borehole to remove any soil particles and contami-

nants. In this manner the possibility of cross-contamination between boreholes will be substantially reduced. Decontamination of the equipment is quick and sure because there are no internal pump mechanisms or hoses. Contaminated wash water will be treated and/or disposed of in an environmentally acceptable manner. Split spoons will be decontaminated with cleaning solution and potable water between use. Additional details appear in Appendix D.

Geraghty & Miller, Inc.'s field geologist will carefully describe all split-spoon samples collected as the hole is drilled and prepare a log for each boring. In addition to the normal lithologic and hydrologic description, the samples will be examined and described in the field for the presence of contamination in a qualitative manner using the discoloration of the soil, and/or the results of field organic vapor analysis. All soil samples slated for laboratory analysis will be packed without headspace and quickly sealed in clean, 4-ounce size airtight glass jars provided by the analyzing laboratory and kept cool until delivered to the laboratory. Formal chain-of-custody protocols will be observed for all samples.

Wells will be constructed in accord with the attached NJDEP diagrams except that the casings will be 2-inch diameter steel and the screens will be 2-inch diameter stainless steel.

The screens will be 10-15 feet long (as geology dictates) and will have 10-slot openings. This slot size is large enough to allow sufficient water into the wells for sampling purposes and, with a sand pack will reduce the migration of fine grained material into the well. The screen zone of each well will be sand packed with an appropriate sized sand.

The sand pack will extend to approximately one to two feet above the top of the well screen. An as-built construction record will be prepared for each well and and included in the appropriate report.

A granular bentonite seal approximately one foot thick will be emplaced in the borehole annulus on top of the sand pack. Such a seal is preferable to a seal made with bentonite pellets, which tends to hydrate and swell before settling to the bottom of the hole and have a tendency to bridge and prevent a good seal from forming. The granular bentonite tends to descend rapidly in the water column with little hydration until it has descended to the top of the sand pack. After hydration occurs, the granular bentonite provides an excellent seal. Above the granular bentonite, bentonite slurry will be tremied into the borehole annulus from the bottom of the hole up to land surface. The granular bentonite and the bentonite slurry prevent surface water from migrating down the disturbed annular soil zone of the borehole and at the same time prevent any water from the saturated zone above the screened zone from migrating down the borehole. In this manner the screened zone is sealed off from all zones above the screen, and any water samples subsequently collected from the well will be representative of the screened zone.

Before the sand pack is added to the borehole, the auger flytes will be backed up to expose the screened section to the formation. Then, the sand pack will be added. The reason for proceeding in this manner is to prevent a sand lock from occurring between the well and the auger flytes,

which would result in the well being pulled from the hole when the augers are pulled back. After the sand pack has been installed, the granular bentonite seal will be put in, after which the auger flytes will be backed up an additional few feet. Finally, bentonite slurry will be added to the hole and the remaining auger flytes will be pulled from the hole. The well will be finished with a 2-foot stickup above land surface, and a vented cap will be placed on top of the well. This cap will keep precipitation from directly entering the well, yet at the same time it will allow the water level in the well to fluctuate according to water-level changes in the formation. The well, to be completed with a protective outer casing and locking lid, will be labeled with a permanent marker. Provisions will be made during installation by this method to ensure that the integrity of the screen is not compromised. Where site accessibility prohibits the use of truck- or tract-mounted rigs, the wells will be driven with a portable tripod and drive weight.

Pumping with a suction pump should be possible because of the relatively shallow depth to water at the site. Well development will be carried out with either a centrifugal pump, an air compressor, or by bailing. If the wells yield freely, a centrifugal pump or compressor will be used. However, if the formation material surrounding the well screen is relatively tight and low yielding, it may be necessary to bail the wells because a steady yield will not be attainable. The purpose of the development is to be sure that the well screen is open to the surrounding formation and make the water as sediment-free as practical.

Water-Level Measurements

All water-level measurements in wells will be made with the use of a chalked measuring tape with weight. This measurement technique is very reliable, consistent, and extremely accurate. The tape is calibrated to 0.01 ft. At each well prior to making readings, the length of tape to be lowered into the well will be cleaned with detergent and then distilled or deionized water. After the tape has been wiped dry, several feet of the bottom of the tape will be covered with blue carpenter's chalk. The tape will then be lowered into the well and held at an appropriate marking opposite the top of the casing. The held and wet marks on the tape will be recorded along with well identification, date and time of measurement.

Surveying

After all wells have been installed, a licensed surveyor will determine the elevations of the tops of all well casings with respect to the mean sea level datum. The elevation of each well will be determined to the nearest one hundredth of a foot. At each well, the actual point on the casing that was surveyed in will be appropriately marked by the surveyor.

Permits

Applicable NJDEP permits will be obtained for all wells and soil borings.

APPENDIX A

Protocol for Screening Soil Samples for Volatile Organic Compounds

Equipment:

TIP or HNU

Sample jars with lids (approximately 4-ounces)

Polyethylene sheeting

Rubber band

Procedure:

1. Transfer a representative portion of the sample into the sample jar and fill it approximately halfway.

2. Seal the jar with a piece of the polyethylene sheeting and secure it with a rubber band.

3. Store the sample for at least one hour in a warm area (25°C minimum).

4. In order to take a measurement, push the intake probe of the instrument through the plastic, taking care not to allow soil or water to enter the intake.

5. Record the highest reading, which usually occurs within 5 seconds of puncturing the seal. Allow meter to return to zero before next measurement.

APPENDIX A

WELL POINT INSTALLATION PROTOCOL

- Set up portable tripod over proposed well point location. The work will be performed by a New Jersey licensed driller.

- Steam clean new stainless-steel 2-inch diameter drive point screen (total length, 10 ft) and new black steel casing lengths to remove all traces of dirt dust, cutting oils, and grease. The screen will be 10 ft long; the screen and casing will be "drive point" material.

- Securely screw together well point and five-foot section of casing using clean pipe wrenches; wrenches should be steamed clean. Measure and record the length of the casing/screen assembly and any casing subsequently added.

- Hold well point and casing assembly vertical while driving it with standard drive weight to desired depth. During the installation process, periodically stop the driving action and check/measure the depth to water below the top of the casing, being sure to also record the height of casing above land surface. Care will be

taken during installation to prevent collapse of the Well Screen.

- Measure the depth to water using a chalked steel tape and clean the tape with deionized water prior to its insertion into the well.

- When the well has been driven to its required depth, stop the driving action and affix a hand pump or centrifugal pump to the well casing.

- Pump water from the well into a drum for a sufficient time to be sure that the water is as sediment free as possible and that the screen is open to the formation. Drumming the water is necessary in case it is hazardous; the drum also allows easy measurement of the volume pumped.

- Periodically during development collect a water sample for field analysis of pH and specific conductance.

- At the completion of development allow the water level to stabilize and measure and record its depth from the top of the well casing. Also record the height of the casing above land surface and the screened interval below land surface.

- Securely cap the well with a screw or vented cap by using a wrench. Permanently label the well casing with its appropriate identification.

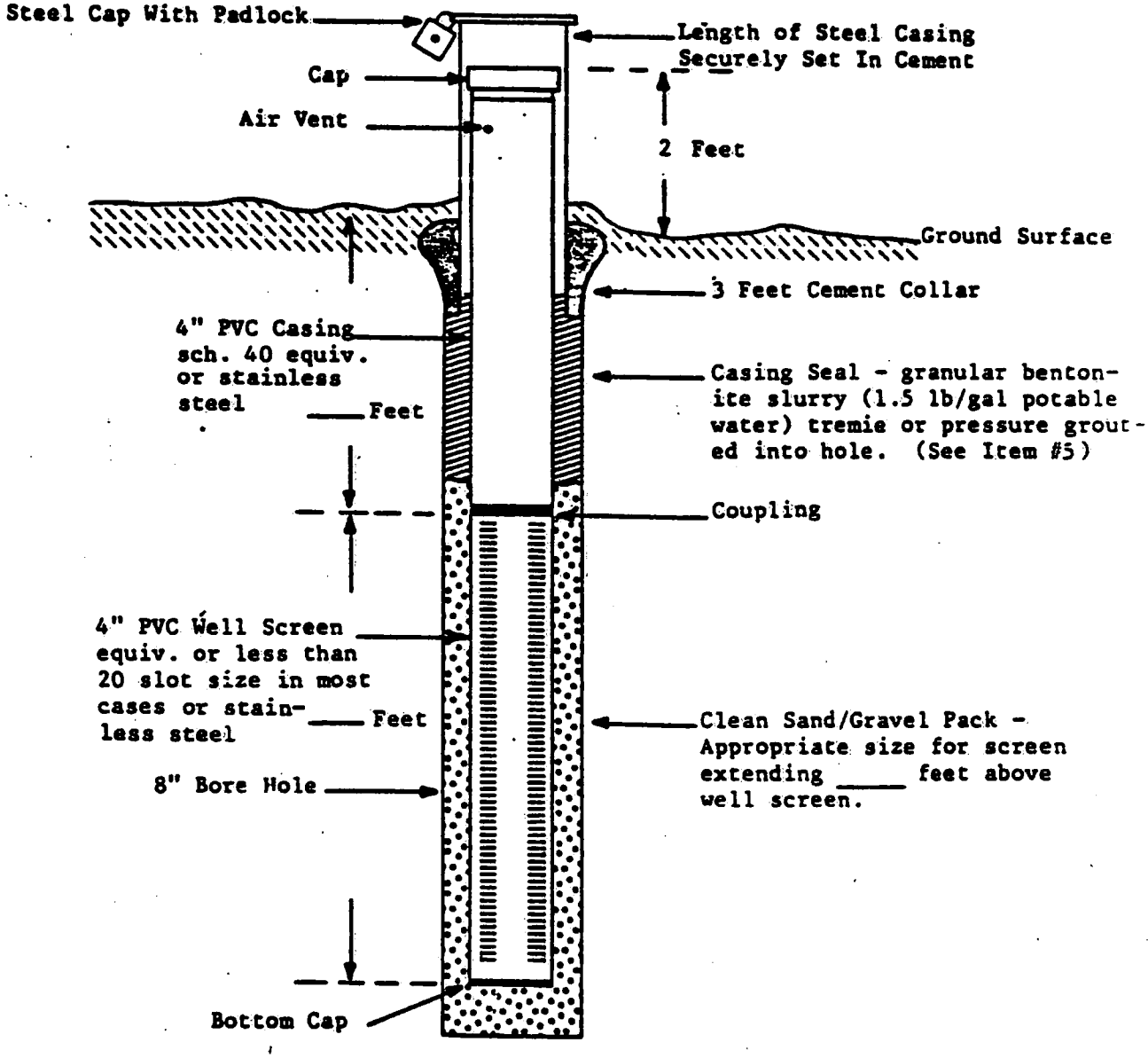
- Make an accurate location sketch for the well.

New Jersey Department of Environmental Protection
Unconsolidated Monitor Well Specifications*

Site Name: _____

Location: _____

Date: _____



NOT TO SCALE

REQUIREMENTS:

1. Notification to the NJDEP is required two (2) weeks prior to drilling.
2. State well permits are required for each monitor well constructed by the driller. Report "use of well" on well permit application. Permit number must be permanently affixed to each monitor well.

OVER PLEASE

3. The borehole must be a minimum of four (4) inches greater than the casing diameter.
4. Wells must be gravel packed unless noted otherwise in Additional Requirement #8.
5. Approved high grade sodium base, well sealant type, granular bentonite must be used to seal casing. Casing sealant and drilling fluids must be mixed with potable water.
6. All wells must be developed upon completion for a minimum of one (1) hour or to yield a turbid-free discharge.
7. The driller must maintain an accurate written log of all materials encountered in each hole, record all construction details for each well, the static water levels, and any tidal fluctuations (when applicable). This information must be submitted to the Office of Water Allocation as required by N.J.S.A. 58:4A.
8. If low level organic compounds are to be sampled for, only threaded or press joints (no glue joints) are acceptable for PVC.
9. A length of steel casing with a locking cap must be securely set in cement a minimum of three (3) feet below ground surface.
10. Top of casing (excluding cap) must be surveyed to the nearest hundreth foot (0.01) by a licensed surveyor. The casing must be permanently marked at the point surveyed. The well(s) should be numbered clearly on the casing. A detailed site map with the well locations and casing elevations must be submitted to _____ _____ _____.

11. NOTICE IS HEREBY GIVEN OF THE FOLLOWING:

a. Review by the Department of well locations and depths is limited solely to review for compliance with the law and Department rules;
b. The Department does not review well locations or depths to ascertain the presence of, nor the potential for, damage to any pipeline, cable or other structure;
c. The permittee (applicant) is solely responsible for safety and adequacy of the design and construction of wells required to be constructed by the Department;
d. The permittee (applicant) is solely responsible for any harm or damage to person or property which results from the construction or maintenance of any well; this provision is not intended to relieve third parties of any liabilities or responsibilities which are legally theirs.

ADDITIONAL REQUIREMENTS (IF CHECKED):

☐1. Top of screen set _____ feet above/below water table.

☐2. Split Spoon Samples _____

☐3. Dedicated Bailer (Sampler) In Well(s) _____

☐4. Threaded or Press Joints _____

☐5. Five (5) Foot Casing Tailpiece Below Screen _____

☐6. Centralizers On Screen _____

☐7. Borehole Geophysical Log(s) _____

☐8. Other _____

_____

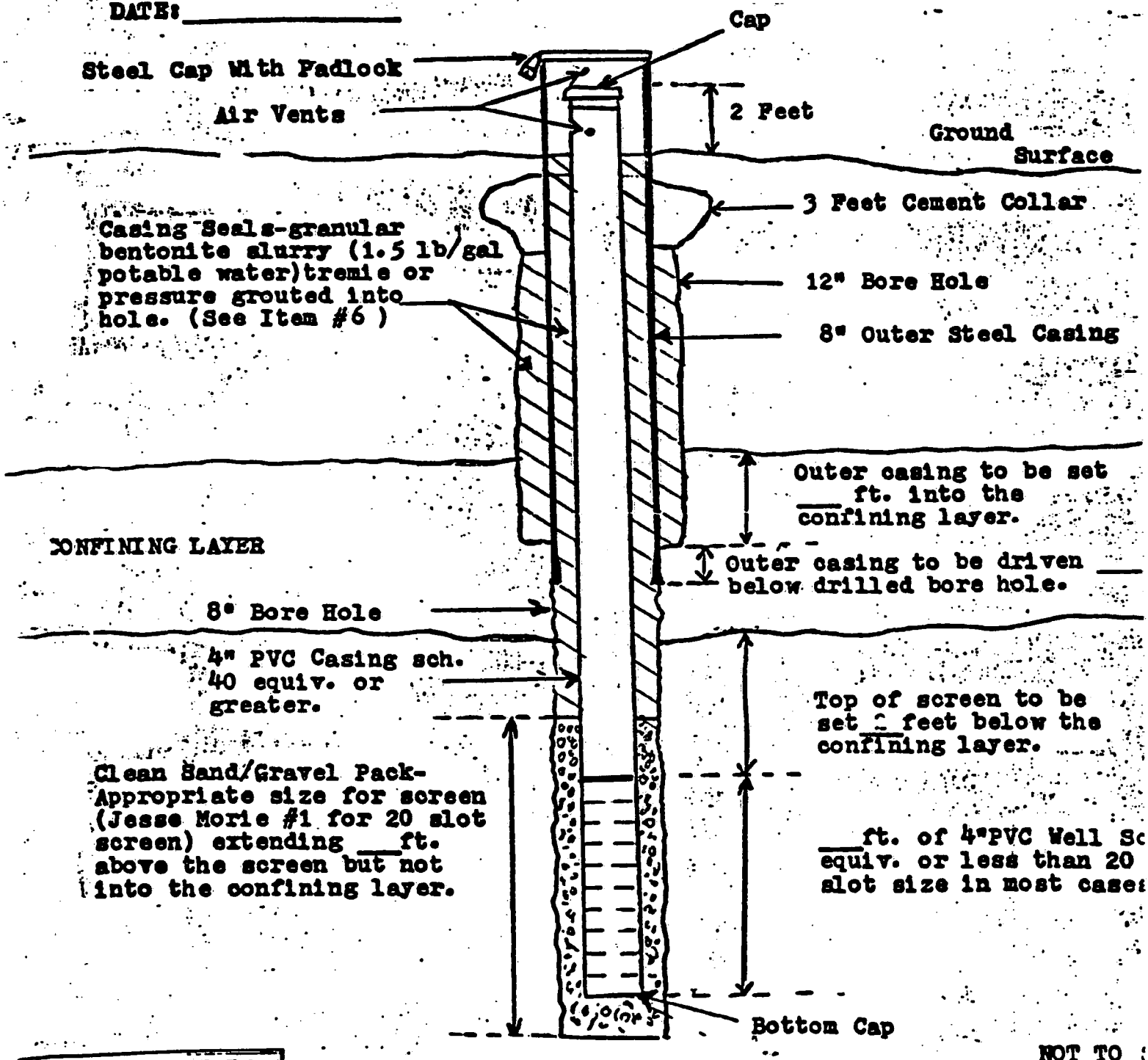
* OTHER MATERIALS, DESIGNS AND CASING DIAMETERS MAY BE USED WITH PRIOR APPROVAL BY THE NJDEP.

MONITOR WELL SPECIFICATIONS FOR CONFINED UNCONSOLIDATED AQUIFERS *

SITE NAME: _____

LOCATION: _____

DATE: _____



NOT TO

REQUIREMENTS:

1. Notification to the NJDEP is required two (2) weeks prior to drilling.
2. State well permits are required for each monitor well constructed by the driller. Report "use of well" on well permit application as grou water monitoring. Permit number must be permanently affixed to each monitor well. NOTE: Well driller must be licensed in the State of New Jersey.

OVER PLEAS

3. All boreholes must be a minimum of four (4) inches greater in diameter than the immediate casing it surrounds.
4. Wells must be gravel packed unless noted otherwise in Additional Requirement #7 and under no circumstance is the gravel pack to penetrate a confining layer.
5. Approved high grade sodium base, well sealant type, granular bentonite must be used to seal all casings. Casing sealant, drilling fluids and cement must be mixed with potable water.
6. The bore hole for the outer steel casing is to be drilled and the casing driven, grouted and allowed to set prior to drilling through any confining layer.
7. The grout for the inner PVC cased well must extend to the ground surface.
8. The cement collar should be installed one (1) hour after the inner casing seal has been emplaced and not while the outer casing seal is setting.
9. All wells must be developed upon completion for a minimum of one (1) hour or to yield a turbid-free discharge.
10. The driller must maintain an accurate written log of all materials encountered in each hole, record all construction details for each well, the static water levels, and any tidal fluctuations (when applicable). This information must be submitted to the Office of Water Allocation as required by N.J.S.A. 58:4A.
11. If organic compounds are to be sampled for, only threaded or press joints (no glue joints) are acceptable.
12. Locking caps must be provided to secure each well.
13. The top of the inner PVC casing (excluding cap) must be surveyed to the nearest hundreth foot (0.01) by a libensed surveyor. The inner casing must be permanently marked at the point surveyed. The well should be numbered clearly on the outer casing. A detailed site map with the well location and casing elevation must be submitted to _____.
14. NOTICE IS HEREBY GIVEN OF THE FOLLOWING:
    a. Review by the Department of well locations and depths is limited solely to review for compliance with the law and Department rules;
    b. The Department does not review well locations or depths to ascertain the presence of, nor the potential for, damage to any pipeline, cable or other structure;
    c. The permittee (applicant) is solely responsible for safety and adequacy of the design and construction of wells required to be constructed by the Department;
    d. The permittee (applicant) is solely responsible for any harm or damage to person or property which results from the construction or maintenance of any well; this provision is not intended to relieve third parties of any liabilities or responsibilities which are legally theirs.

ADDITIONAL REQUIREMENTS (IF CHECKED):

11. Split Spoon Samples _____
12. Dedicated Bailer (Sampler) In Well(s) _____
13. Threaded or Press Joints _____
14. Five (5) Foot Casing Tailpiece Below Screen _____
15. Centralizers On Screen _____
16. Borehole Geophysical Log(s) _____
17. Other _____

* OTHER MATERIALS, DESIGNS AND CASING DIAMETERS MAY BE USED WITH PRIOR APPROVAL BY THE

New from McGraw-Edison:
PCB field test kit for screening oil and soil

Simple to operate.
Inexpensive.
Portable.
Fast.

McGraw-Edison Power Systems Division has announced the introduction of a PCB field test kit* for determining PCB concentration levels in electrical apparatus oil. About the size of a weekend bag and just as easy to carry, the McGraw-Edison PCB Field Test Kit provides a fast, inexpensive, on-site method to accurately identify transmission and distribution equipment contaminated with PCBs. Soil testing equipment, which fits in the same case, also is included. The combination oil/soil kit reduces handling and storage, and saves time.

DESCRIPTION

The PCB field test kit (Figure 1) is used to screen dielectric fluid for PCB contamination, combining a simple, three-step chemical procedure with electronic measurement and digital readout. Designed for use in the field, the PCB field test kit is battery operated and, weighing only 16 pounds, is fully portable.

The PCB field test kit features:

- Rapid determination of PCB contamination level.
- Emergency on-site analysis.
- Simple, three-step procedure.
- Operation by nontechnical personnel.
- Low cost per sample.
- Excellent precision and accuracy.

APPLICATION

On May 31, 1979, the Environmental Protection Agency (EPA) published the PCB Ban Rule in the Federal Register, establishing criteria for three levels of PCB contamination in dielectric fluids:

- PCB levels greater than 500 ppm: PCB fluid.
- PCB levels from 50 to 500 ppm: PCB-contaminated fluid.
- PCB levels less than 50 ppm: Non-PCB fluid.

The field test kit is a quick and economical means of estimating actual PCB contamination. The contamination is determined by comparing the kit's digital meter response to a corresponding table of PCB parts per million.

*Developed and originally marketed by Centec Analytical Services Division of Centec Corporation, the PCB Field Test Kit has been added to the McGraw-Edison Power Systems Division line of products to broaden our service to customers. Assembly and quality testing of kits are being performed by our Thomas A. Edison Technical Center.

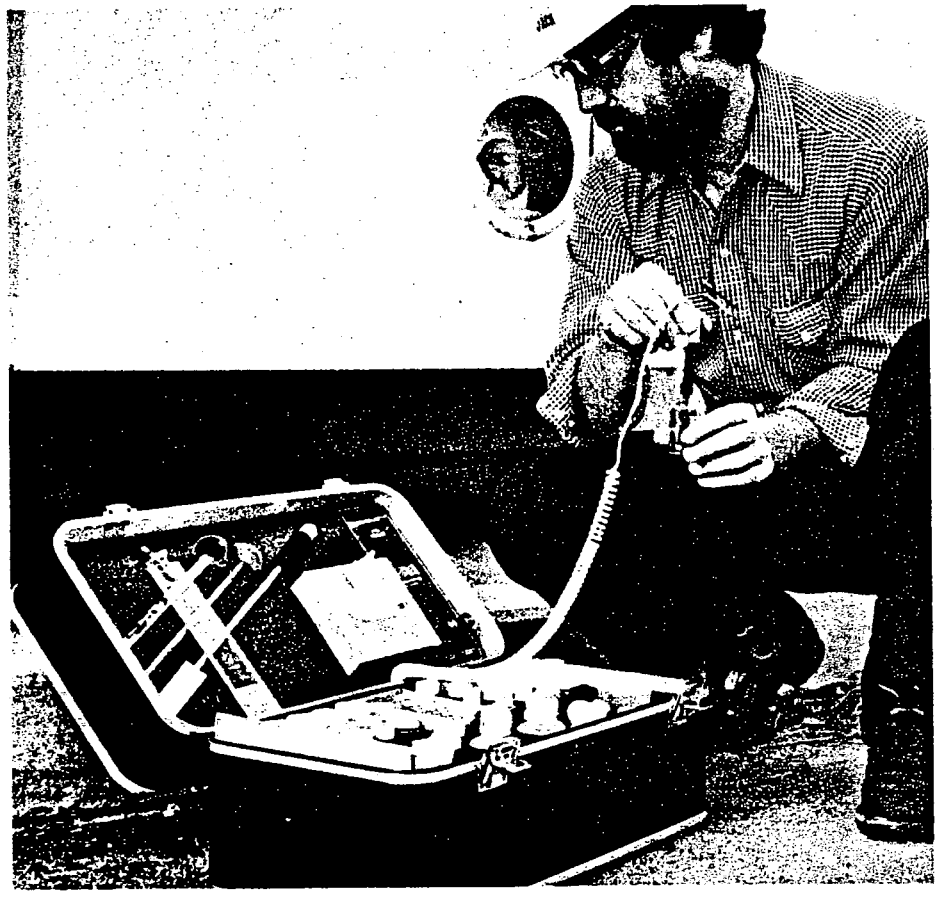


Figure 1.
McGraw-Edison's new PCB field test kit.

Routine Testing

The regulations specify that a mineral oil transformer must be considered a PCB-contaminated transformer unless tests prove otherwise. The kit can perform in a routine test program to provide this proof.

Critical Locations

The EPA requires that transformers be removed or proven not to contain PCBs if they are in critical environmental areas, such as near food processors or water supplies. The kit facilitates compliance and reduces associated costs.

Repair and Maintenance

Many management and union policies now require that a PCB analysis be performed before a transformer can undergo servicing or repair. The kit eliminates costly delay.

McGRAW-EDISON

Choice without compromise.

PCB Spills

In the event of a dielectric liquid spill, the kit can assess environmental risk on site, immediately. If PCB is present, the soil testing equipment provides quick readings before and during clean-up, thus saving time and costs.

FIELD TEST PROGRAM

The PCB field test kit can be set up at the site of each transformer or other apparatus, or at a convenient sample collection point. The kit must be calibrated before the first sample is tested; thereafter, it must be calibrated after five tests have been completed, hourly, or each time it is moved to a new site—whichever occurs first. After the kit is calibrated, each oil sample can be analyzed in five minutes, using a simple, three-step process:

1. Fit a clean disposable pipet tip to the 1-mL pipetor. Use the pipetor to transfer a sample of the oil to a reaction vial containing premeasured reagents. Cap the vial and shake for 20 seconds.
2. Use the 5-mL pipetor to transfer the oil extraction fluid to the reaction vial. Cap the vial and shake for ten seconds. Wait two minutes for the two layers to separate.
3. Rinse and dry the probe. Immerse the probe in the lower layer. Mix gently for two minutes. Record the probe response on the permanent record sheet and note the contamination level.

The PCB field test kit offers excellent accuracy in comparison with laboratory analysis and precision in duplicating results. This level of accuracy becomes critical only near the EPA category limits of 50 and 500 ppm. Therefore, the kit incorporates in its analysis charts and tables the two safety ranges (TEST-50 and TEST-500) for both Aroclor 1242 and Aroclor 1260 where laboratory analysis is recommended for confirmation.

Experience with this kit has shown that, as a rule, approximately 70 of every 100 transformers tested can be classified as non-PCB transformers and will require no further action. For these, then, servicing or repair could begin as soon as the five-minute test is complete. Some of the remaining 30 transformers may fall in the TEST-50 or TEST-500 range, and for these, laboratory confirmation would be recommended.

SOIL TESTING EQUIPMENT

To facilitate on-site soil testing in the event of a suspected PCB oil spill, soil testing equipment (Figure 2) is also included in the kit. The easily assembled, three-ft-long soil collector (designed for use from a standing position) picks up soil in ½-in. depths, so that a number of samples of near-uniform depth can be quickly gathered over a prescribed area in a cross pattern. The collected soil is then mixed with an equal weight of soil extraction solvent and allowed to settle. The soil extraction solution can then be tested in accordance with the standard three-step procedure used in testing dielectric fluid.

Figure 2.
Demonstration of soil collector. (Safety procedures may be required in actual use)

COST COMPARISON

Using the PCB field test kit, testing can be performed at a fraction of the cost of laboratory analysis. Figure 3 compares the cost of kit analysis with the cost of gas chromatography (GC) analysis, in terms of the number of samples analyzed.

The curve for GC analysis assumes an average of $65 per sample for laboratory testing (based on estimates of the Electric Power Research Institute). The curve for kit analysis reflects only direct analytical cost. The saving demonstrated does not include time and labor saved by using the kit.

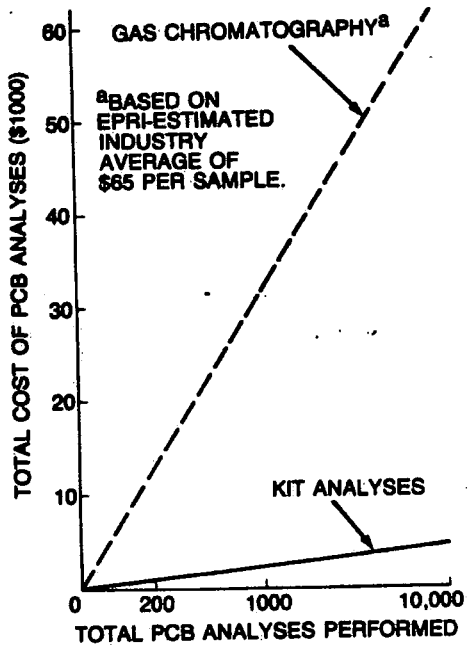


Figure 3.
Cost comparison: Kit analysis and gas chromatography.

ADDITIONAL INFORMATION

For additional information about the McGraw-Edison PCB Field Test Kit, contact your McGraw-Edison representative, write to McGraw-Edison Company, Power Systems, PO Box 2850, Pittsburgh, PA 15230, or telephone (412) 777-3200.

In Canada, write to McGraw-Edison Limited, 3595 St. Clair Avenue East, Scarborough, Ontario, M1K 1M1.

Replacement reagents are available in kits of 20 and 500 through your McGraw-Edison representative.

NOTE: The PCB Test Kit can be purchased under the lastest GSA Schedule. Contact McGraw-Edison Company, Power Systems, PO Box 2850, Pittsburgh, PA 15230.

McGRAW-EDISON

Bulletin 83029
April 1984 • Supersedes 10/83

Power Systems
McGraw-Edison Company
Post Office Box 2850
Pittsburgh, PA 15230

APPENDIX B

HEALTH AND SAFETY PLAN

Appendix B

HEALTH AND SAFETY PLAN

Introduction

This Health and Safety Plan (HASP) has been developed to protect the health of personnel during the course of the site investigation at the UOP site in East Rutherford, NJ. This HASP was prepared based on principles of industrial hygiene and Geraghty & Miller, Inc. experience, using current Federal regulations and published guidelines, texts and references.

Management

All site operations will be under the direction of the project geologist. This individual is empowered to make the routine decisions on working conditions and safety equipment selection. At the beginning of the day, site personnel will be briefed on the expected activities for that day by the site manager; this will include a discussion of specific hazards. The project geologist reports directly to the Safety Manager on safety issues. The Safety Manager is responsible for the preparation and implementation of the HASP and is the only one who may make changes in the HASP. Disputes over safety issues will be resolved by the Safety Manager.

Hazard Evaluation

Along with the normal hazards associated with well drilling and installation, there are potential chemical hazards present at this site. Previous investigations at this site have determined the presence of volatile organic compounds (VOCs), acid and base/neutral extractable compounds, polychlorinated biphenyls (PCBs) and heavy metals in the soil, surface water and ground water. Table B-1 lists organic compounds detected above 100 ppb (ug/L or ug/kg) in water or soil samples. Volatilization of VOCs from contaminated soil and water poses a potential inhalation hazard to investigation personnel. Contaminated soil and water also pose a potential contact hazard to investigation personnel, through subsequent ingestion or skin absorption. The equipment and procedures specified in this HASP were selected to detect and minimize these hazards.

The VOCs which were found in the highest concentrations at the site are benzene, toluene and chlorobenzene. The Threshold Limit Values-Time Weighted Average (TLV-TWA) for the compounds are given in Table B-2. TLVs are published yearly by the America Conference of Governmental Industrial Hygienists; the TWA represents an acceptable level for repeated exposure based on an 8-hour day, 40-hour week. Benzene has the lowest TLV-TWA (10 ppm); thus an action

level of 10 ppm above ambient for respiratory protection will be employed.

Air Monitoring

Air monitoring with direct reading instruments will be conducted during drilling operations. The air around the borehole will be surveyed, as will the atmosphere at shoulder height (breathing zone) around the rig. In addition, the breathing zone will be monitored during trench digging and all soil sampling operations. The data shall be recorded so that emissions and environmental concerns can be evaluated.

The main survey instrument employed will be an HNU Model PI-101 Photoionizer equipped with a 10.2 eV lamp or a Photovac TIP (10.6 eV lamp). These instruments employ photoionization detectors, which are particularly sensitive to aromatic and halogenated organic compounds such as the ones found at the site. The survey instrument will be calibrated according to the manufacturer's instructions.

Personal Protective Equipment

The standard work uniform for personnel involved in investigation activities will be as follows:

- Tyvek coveralls
- Boots, rubber - mid-calf
- Gloves, rubber, PVC, or equivalent; minimum 10" gauntlet

- Hard hat
- Safety glasses or goggles

As explained previously, respiratory protection will be required if concentrations of 10 ppm or more above ambient are detected during monitoring. All respiratory protection will be NIOSH/MSHA approved.

If conditions become particularly sloppy or dusty due to weather, more stringent protection will be employed, including, but not limited to:

- Inner Gloves
- Taping boots and gloves to coveralls to eliminate possible leakage at the wrist and ankle
- Polyethylene-coated coveralls or raingear
- Face Shields
- Hoods.

Decontamination

Zones will be established in the vicinity of drilling or excavation sites as follows:

Exclusion Zone (within 30 ft of rig or trench)

- No eating, drinking or smoking
- Personnel dressed in suit and gloves and respirators if field monitoring indicates the need.

Contaminant Reduction Zone (adjacent to Exclusion Zone)

- Area used for decontamination
- Wash water and eye wash station
- Drum for trash and disposable clothing
- No eating or drinking

Clean Zone

- Storage of clean equipment
- Area of unrestricted access for site personnel and authorized visitors
- Eating or drinking allowed

All personnel working in the Exclusion Zone will be required to pass through the Contaminant Reduction Zone before entering the Clean Zone. In the Contaminant Reduction Zone, personnel will remove clothing and equipment, starting with the most likely contaminated item: boots, followed by gloves, coveralls and respirators. Equipment used in the Exclusion Zone will be left in the Contaminant Reduction Zone until it is decontaminated. Personnel will be required to wash their face and hands thoroughly before leaving the Contaminant Reduction Zone. Any direct skin contact with contaminated materials will require removal of clothing and cleaning with soap and water.

Drilling and sampling equipment will be cleaned by steam cleaning or washing with a mixture of MICRO^{Tm} cleaning

solution followed by a rinse with potable water. Sampling equipment will have a final distilled water rinse. It has been our experience that the use of volatile organic solvents (for example, hexane, acetone) as cleaners can lead to the contamination of samples as well as posing the threat of fire or explosion.

All equipment will be thoroughly washed with detergent and potable water followed by steam cleaning before leaving the UOP site. The tires of drilling rigs and trucks will be washed before leaving the site.

Training

Geraghty & Miller, Inc. employees are required to attend a 3-hour course given in-house on safety at chemical plants and waste sites. Additionally, selected employees attend 5-day type courses (EPA, National Water Well Association, and others). Before being allowed to work unsupervised at any site, new employees work several days with an experienced employee.

Prior to initiating site work, all site personnel (Geraghty & Miller, Inc. and subcontractors) will be required to attend a training session given by the Safety Manager. This session will include the following topics:

- Site history
- Specific hazards (including toxicological data)
- Hazard recognition

- Standard operating procedures
- Decontamination (personnel and equipment)
- Emergency procedures
- Respirator fit and use.

Medical Surveillance

Geraghty & Miller, Inc. has established a Health Monitoring Program with occupational health specialists at Long Island Jewish Hospital in New Hyde Park, New York. All site personnel (Geraghty & Miller, Inc. and subcontractor) who will perform daily site activities will have had an examination within 12 months preceding the start of on-site work, and will receive exit physicals within one month of completion of the on-site program.

The standard examination consists of the following:

- Personal, family and environmental history
- Hands-on physical examination
- Snellen's eye examination
- Pap smear (females over age 21)
- Hemoccult testing (over age 40)
- Laboratory testing:
  - A. Complete Blood Count:
    1. Red blood count
    2. White blood count
    3. Differential screening

4. Hemoglobin
5. Hematocrit

B. Urinalysis:

1. Sugar
2. Albumin
3. Specific gravity
4. Microscopic

C. Laboratory Chemistries:

1. A/G Ratio
2. Albumin
3. Alkaline, Phosphatase
4. Bilirubin, Total
5. Calcium
6. Chloride
7. Cholesterol
8. Creatinine
9. GGT
10. Globulins
11. Glucose
12. Iron
13. Lactic Dehydrogenase (LDH)
14. Phosphorus
15. Potassium
16. Protein, Total
17. SGOT
18. SGPT
19. Sodium

20. Triglycerides
21. Urea Nitrogen (BUN)
22. Uric Acid

D. Special Testing

1. PCBs in serum

Contingency Plan

The only investigation activity which could conceivably release hazardous materials is the excavation activity in Area 5. The excavations will be advanced in six inch lifts in order to minimize the possibility of rupturing drums. In the event that an intact drum is ruptured, the drum will be placed in an over-pack drum. Sorbent material will be kept on site for collection/containment of spilled materials. Filled drums will be labelled and kept on site until disposal arrangements can be made.

Emergency Procedures

In the event of serious physical injury, the local rescue squad may be contacted, or the injured person may be taken directly to the nearest hospital which is St. Mary's Hospital, 211 Pennington Avenue, Passiac, New Jersey (201-470-3000). In the event of a fire or potentially hazardous chemical release, the local fire department will be summoned. Emergency phone numbers are as follows:

Ambulance Corps.	201-438-1800
Fire department	201-939-1133

These numbers, along with directions to the hospital, will be kept on site during the investigation.

Table B-1: Organic Compounds Present in Soil and Water at the Allied-Signal UOP Site, East Rutherford, New Jersey

Volatile Organic Compounds
benzene
chlorobenzene
1,1,2,2-tetrachloroethane
1,2-Trans-dichloroethylene
ethylbenzene
methylene chloride
tetrachloroethylene
toluene
trichloroethylene
vinyl chloride
acetone
carbon disulfide
total xylenes
furan, tetrahydro-tetramethyl

Base/Neutral Compounds
acenaphthene
1,2,4-trichlorobenzene
hexachlorobenzene
bis(2-chloroethyl) ether
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2-diphenylhydrazine (as azobenzene)
fluoranthene
isophorone
naphthalene
N-nitrosodiphenylamine
bis(2-ethylhexyl) phthalate
butyl benzyl phthalate
di-n-butyl phthalate
benzo(a)anthracene
benzo(a)pyrene
3,4-benzofluoranthene
benzo(b)fluoranthene
benzo(k)fluoranthene
chrysene
acenaphthylene
enthracene
benzo(ghi)perylene
fluorene
phenathrene
dibenzo(a,h)anthracene
indeno(1,2,3-cd)pyrene
pyrene

Table B-1 (continued)

Base/Neutral Extractable Compounds
benzene,1,1-sulfonyl bis
cyclohexane,3,3,5-trimethyl
ethane,1,2-bis(2 chloroethoxy)
alkane
sulfur
methanone, diphenyl
benezene,1,1-methylene bis
benzene,1-(1,1-dimethylethyl)
benzene, acetonitrile
benzene,1,1 - (oxybis (methylene))

Acid Extractable Compounds
p-chloro-m-cresol
2-chlorophenol
phenol
benzoic acid,4(-1,1-dimethylethyl)
phenol,4-(1,1-dimethylethyl)
benzoic acid,4,-chloro
phenol,2,4-bis (1-methylethyl)
phenol,2,6-bis (1,1-dimethylethyl)
benzene, acetic acid
benzoic acid, 3-methyl

Non-Priority Pollutant Hazardous Compounds
4-methylphenol

Other Priority Pollutants
Polychlorinated biphenyls

Table B-2 Threshold Limit Values for Prominent Volatile Organic Compounds at the Allied-Signal UOP Site, East Rutherford, New Jersey

Compound	Threshold Limit Value (ppm)
Benzene*	10
Chlorobenzene	75
Toluene	100

*Suspected human carcinogen

Table B-3. Equipment to be kept on site.

Respiratory Protection

MSA Ultra Twin Full Face Cartridge Mask
MSA Comfo II Half Face Cartridge Mask
Organic Vapor Cartridges

Protective Clothing

Tyvek™ Coveralls - various sizes
Raingear - Jacket/Pants
Rubber Boots - min. 10" height
Gloves - Nitrile, PVC or equivalent, min. 10" gauntlet
Hard Hats
Safety Glasses or Goggles
Face Shields - hard hat compatible
Gloves - surgical type, latex, polyethylene or equivalent

Other

Duct Tape
Scrub Brushes
Buckets
First Aid Kit
HNU PI 101 Photoionizer or Photovac TIP
Plastic Sheeting

APPENDIX C

LIST OF NJDEP-APPROVED LABORATORIES

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
APPROVED LABORATORIES (LISTED ALPHABETICALLY)
REQUIRED FOR EPA-CLP LEVEL WORK

Name and Address	Organics (Priority Pollutants) and HSL	Dioxins	Furans	Inorganics (Priority Pollutants)	Inorganics HSL
California Analytical Laboratories 2544 Industrial Blvd West Sacramento, CA 95691 (916) 372-1392	Yes	Yes	Yes	Yes	Yes
Cambridge Analytical Associates, Inc. 1106 Commonwealth Avenue Boston, MA 02215 (617) 232-2207	Yes	No	No	Yes	Yes
CompuChem Laboratories P.O. Box 12652 3308 Chapel Hill/ Nelson Highway Research Triangle Park, NC 27709 (919) 549-8263	Yes	Yes	No	Yes	Yes
EA Engineering Science & Technology Hunt Valley Loveton Center 15 Loveton Sparks, MD 21152 (301) 771-4950	Yes	No	No	Yes	No
Environmental Research Group 117 North First Street Ann Arbor, MI 48104 (313) 662-3104	Yes	No	No	Yes	No
Environmental Testing Corporation P.O. Box 7808 Edison, NJ 08818-7808 (201) 225-5600	Yes	Yes	Yes	Yes	Yes
IT, Cerritos (Cerritos, WCTS) 17605 Fabrica Way, Suite D Cerritos, CA (714) 523-9200	Yes	No	No	Yes	No

Name and Address	Organics (Priority Pollutants) and HSL	Dioxins	Furans	Inorganics (Priority Pollutants)	Inorganics HSL
IT, Knoxville 312 Directors Drive Knoxville, TN 37923 (615) 690-3211	No	Yes	No	No	No
IT, Knoxville 5815 Middlebrook Pike Knoxville, TN (615) 588-6401	Yes	No	No	Yes	No
Nanco Laboratories, Inc. Unity Street & Route 376 P.O. Box 10 Hopewell Junction, NY 12533 (914) 221-2485	Yes	No	No	Yes	No
PEI Associates, Inc. Chester Towers Cincinnati, OH 45246 (313) 732-4700	Yes	No	No	Yes	No
Rocky Mountain Analytical 5530 Marshall Street Arvada, CO 80002 (303) 421-6611	Yes	Yes	Yes	Yes	Yes
Thermo Analytical, Inc. 2030 Wright Avenue Richmond, CA 94804-0040 (FORMERLY EAL) (415) 235-2633	Yes	No	No	Yes	No
U.S. Testing Company, Inc. 1415 Park Avenue Hoboken, NJ 07030 (201) 792-2400	Yes	No	No	Yes	Yes
Weston Laboratory 256 Welsh Pool Road Lionville, PA 19353 (215) 524-0180	Yes	No	No	Yes	No

May 1986
DWM/OQA

APPENDIX D

GROUND-WATER QUALITY SAMPLING

SEDIMENT SAMPLING

APPENDIX D

GROUND-WATER QUALITY SAMPLING

The following protocol will be used to sample the monitoring wells at the UOP site in East Rutherford, New Jersey, and is based on accepted procedures that have been adopted by Geraghty & Miller, Inc. for use in hydrogeologic investigations.

1.0 Well Evacuation Procedures

1.1 Identify the well and record its designation.

1.2 Clean the top of the well with a clean rag.

1.3 Remove the well cap or plug, wipe the inside of the casing with a clean rag and place the cap down so as to keep it clean.

1.4 Clean the first 5 feet of the steel tape with distilled water and then measure the depth to water.

1.5 Compute the volume of water in 2-inch diameter well (0.162 gallons/feet) or 4-inch diameter well (0.652 gallons/feet).

1.6 Remove five times the volume of standing water in the well using a centrifugal pump, a submersible pump, or a bailer depending upon the static and pumping water levels.

1.6.1 The intake opening of the pump line or pump impellers should be positioned and maintained just below the water surface in the well casing to ensure that the well is properly flushed. As the well's water level decreases as a result of pumping, the intake line should be lowered as needed. This procedure does not have to be followed for

any wells which exhibit a low specific capacity indicated by rapid and pronounced drops in the water level, even to the point where the well is pumped dry.

1.6.2 Ground-water samples will not be collected in the 14-day period after well installation. If the well has been pumped or developed recently, the water level (that is, the volume of water in the casing) may not yet have recovered or returned to its normal state. This does not require a change in the evacuation procedures outlined above. Although the actual volume of water in the casing under such conditions is less than normally encountered, the removal of five times this volume is normally sufficient to provide samples for analysis that are representative of the water in the surrounding formation.

1.6.3 Although no single flushing protocol can cover all conditions, work performed by several researchers indicates that five volumes are generally sufficient.

1.6.4 If the well is pumped dry during this procedure and shows essentially complete recovery within 15 minutes, the removal of water should continue until three to five casing volumes is removed. If recovery is less than 75 percent during the 15 minutes after complete evacuation, sampling can begin. However, the initial volume which eventually becomes available may not be sufficient to complete the sampling in the brief period of time normally required. If this is the case, VOC vials will be filled first, and other bottles will be filled as water becomes available.

2.0 Well Sampling Procedure

2.1 A peristaltic pump equipped with silicone tubing around the pinch rollers and polypropylene tubing for the intake and discharge lines and/or a Teflon or stainless-steel bailer should be used to collect all monitoring well samples except for VOC sampling, which will be done by laboratory-cleaned bailer.

2.1.1 Sample the well directly from the discharge line of the peristaltic pump immediately after the five volumes of water have been removed or collect the samples using the teflon bailer once the well has been properly purged.

2.1.2 If a peristaltic pump is used, all tubing should be removed from the pump and discarded after each well has been sampled. This will minimize the possibilities of cross contamination between successive samples. The polypropylene and silicone tubing avoids contamination of samples with plasticizers, which can leach out of other materials such as Tygon tubing. Similarly, where a bailer is used, it must be thoroughly washed with detergent solution (Micro or similar) and repeatedly rinsed with distilled water before each use.

2.2 In the event that the depth(s) to water preclude the use of a peristaltic pump, samples should be collected using either a stainless steel or Teflon bailer.

2.2.1 The submersible pump and all associated tubing and support lines should be thoroughly cleaned prior to placing it in each well. This can best be accomplished by making up a

detergent solution in a new (clean) 55-gallon drum, submerging the pump and all lines in the drum and pumping the detergent solution out of the drum through the pump and discharge line. This should be followed by a similar "bath and flush" using water of potable quality.

2.3 Split samples should be collected in a common container (except those for volatile organic analysis) that is large enough to fill the required number of sample containers. If a common container is not available and/or practical, the sample may be spilt directly from a bailer with each sample container receiving equal amounts to ensure sample uniformity. Because of the likelihood of aeration during the splitting process using a common container, volatile organic samples are to be collected in sequence.

2.3.1 If a well will not yield the volume of water necessary to immediately fill all of the split sample containers, each container should receive an equal amount from each full bailer. During the sampling of such wells, it is important that partially filled sample bottles be tightly capped, kept out of sunlight and cooled to 4°C, as the delays in obtaining adequate sample volume could otherwise jeopardize the representativeness of the samples.

2.4 Once samples have been collected they should be prepared and preserved in accordance with recommended procedures supplied by the analyzing laboratory.

2.4.1 It is important to note that all water samples designated for heavy-metals analyses should be filtered through a 0.45 micron membrane filter prior to acidification. The membrane may clog readily, so prefiltration through paper and/or fiberglass will expedite the filtration process for samples with more than slight turbidity. (Acidification can displace metal ions adsorbed on particles in the sample that are not initially removed. The unfiltered sample, therefore, usually shows much higher metal concentrations; the higher value corresponds to "dissolved plus displacable" metal-ion concentration.) This is done to ensure that only metal ions initially in solution will be measured.

WELL EVACUATION AND SAMPLING EQUIPMENT

Field book, pens, marking pens, labels.

Clean rags, disposable gloves (optional).

Steel tape, preferably graded in hundredths of a foot.

Chalk for tape.

Distilled water, plastic wash bottle.

Liquid detergent or Micro solution.

Peristaltic pumps and battery or generator.

Silicone tubing.

Polypropylene tubing.

Tools required for opening wells.

Filter paper.

Conical or Buchner funnels.

Vacuum pumps (may use peristaltic pump).

Side-arm flask.

Membrane filtration apparatus (Gelman magnetic).

47-mm, 0.45 um, pore-size membranes.

Fiberglass prefilters, 47 mm.

Pail (preferably graduated).

Ice chest and ice.

pH meter, electrode(s), standard buffer solutions, beakers, conductivity bridge, conductivity cell.

Submersible pump (new 55-gallon drum)

Generator.

Bailers, Teflon or stainless steel.

APPENDIX D

SEDIMENT SAMPLING PROCEDURE

Materials

Bottles as provided by the analyzing laboratory
Liquid detergent or Micro Solution
Lab brush
Screwdrivers (2)
Sledge hammer
Steel tape
30-inch long, 2-inch diameter split-spoon core barrel with retainer clip or a Witco stainless steel sediment sampler
24-inch long"A" rod (2)
Gloves, rubber
Waders
Pipe wrenches (14 inches long, two required)
Tap water and distilled water
Tongue depressors, wooden

Procedure: Start sampling at furthest downstream station and work upstream. Sampling may require construction of a temporary platform across the creek channel at some or all locations.

1. Identify the sampling station location and record it.

2. Stretch the measuring tape across the stream anchoring it on either side. Record the stream width. Drive a wooden stake into dry land on the left bank (looking upstream) for later locating by a surveyor. Label the stake with the station number.

3. Where transects are to be sampled in detail, three borings shall be made approximately 1/4, 1/2, and 3/4 of the way across the channel.

4. Record the depth of the water for each sample.

5. Recover the core barrel and separate the sample (starting at the top) into two 15 inch samples (0-15" and 15-30"). Place each sample into an appropriate sample container, filling the container completely.

6. Identify the sample container(s) in terms of the designation, depth, and the distance from left bank (looking upstream) where the sample was taken.

7. Place the sample on ice and out of direct sunlight.

8. Decontaminate the core tube according to the established protocol.

9. Reassemble core tool and take the next sample.

10. At the conclusion of sample collection, describe the sediments found at the station.

Chain-of-Custody Procedures for Water and Soil Samples

ERT field personnel and the laboratory will follow NJDEP guidelines to assure that the chain-of-custody control measures will withstand legal and technical scrutiny. Chain-of-custody forms will be completed in the field and sealed in the sample shipping cases. Copies of the forms will be kept by the ERT field personnel and sent to the project manager. The original forms will be completed by the laboratory and sent with the test results.

Decontamination Procedures

1. Except as noted below, all field sampling equipment will be laboratory cleaned, wrapped, and dedicated to a particular sampling point. Alternatively, clean, unused disposable field sampling equipment will be utilized.

2. Field cleaning of any equipment used to obtain sediment cores will consist of a manual scrubbing to remove foreign material and steam cleaning inside and out until all traces of oil and grease are removed. Cleaned equipment will be stored to prevent accidental recontamination.

3. Soil coring equipment (for example, split spoons, Shelby tubes) will be field cleaned by sequential cleaning in

- non-phosphate detergent
- tap water rinse
- distilled/deionized water rinse
- 10% nitric acid rinse*
- distilled/deionized water rinse*
- acetone (pesticide grade) rinse
- total air dry or nitrogen blow out
- distilled/deionized water rinse

* only if sample is to be analyzed for metals

2. procedures for decontamination

a. all field sampling equipment shall be laboratory cleaned, wrapped and dedicated to a particular sampling point, unless written permission for field cleaning is obtained from the Department prior to the collection of any samples

b. field cleaning of well casing, well screening and drilling equipment shall consist of a manual scrubbing to remove foreign material and steam cleaning inside and out until all traces of oil and grease are removed; this material shall then be stored in such a manner to preserve it in this pristine condition

c. split spoons, bailers, pumps, etc.

- non-phosphate detergent

- tap water rinse

- distilled/deionized water rinse

- 10% nitric acid rinse*

- distilled/deionized water rinse*

- acetone (pesticide grade) rinse

- total air dry or nitrogen blow out

- distilled/deionized water rinse

* only if sample is to be analyzed for metals

d. hoses

- steam cleaning

- alconox scrub

- alconox flushing

e. the chain of custody for sampling events shall begin with the cleaning of the sampler; wherever possible samplers should be numbered in a manner that will not affect their integrity, wrapped in a material (i.e. aluminum foil) that has either been autoclaved or cleaned in the same manner as the sampler

f. the use of distilled water commercially available in 5 gallon polyethylene carbons is acceptable for sampler

decontamination provided that it is also deionized; use of this water is unacceptable for field and trip blanks unless it has been demonstrated to be analyte free by laboratory analyses.

IMPORTANT NOTE: Use of dedicated sampling equipment is recommended

APPENDIX E

PROTON PRECESSION MAGNETOMETER SURVEY

APPENDIX E

PROTON PRECESSION MAGNETOMETER SURVEY

Fundamental Principles

The earth's magnetic field resembles the field of a large bar magnet near its center or that due to a uniformly magnetized sphere. The origin of the field is not well understood, but thought to be due to currents in a fluid conductive core. The field, or flux, lines of the earth exhibit the usual pattern common to a small magnet where the field is vertical at the magnetic poles and horizontal at the magnetic equator. This description is idealized because the earth is not a homogeneous magnetized sphere and the earth's total field intensity is not symmetrical about the magnetic pole.

Irregularities in the earth's field are quite evident as the total magnetic field ranges from about 25,000 to 70,000 gammas. The gamma is defined as 10^{-5} oersted and is the most commonly used unit of field intensity for geophysical work. Distortions are caused by local variation in the magnetic composition of the earth, solar wind, diurnal fluctuations, and magnetic storms.

Magnetic anomalies in the earth's field result from two different kinds of magnetism, induced and remanent (permanent) magnetization. All substances acquire a certain magnetic intensity when subjected to a magnetizing force, such as that which exists in a magnetic field. This magnetization is lost when the substance is removed from the field. Such magnetism is said to be induced by the field. Some substances, such as iron, nickel, magnetite, and manganese ores exhibit a magnetic action even when

they are not subjected to an external magnetic field. This type of magnetization is referred to as permanent or remanent. Induced magnetization refers to the actions of the earth's field on the material of the object wherein the earth's field is enhanced and the object itself acts as a magnet. The magnetization which occurs is directly proportional to the intensity of the earth's field and the ability of the material to enhance the local field.

During a magnetometer survey, the variations in the intensity of the magnetic field are measured. This is accomplished through the use of a proton precession magnetometer. A precision proton magnetometer utilizes the precession of spinning hydrogen protons to measure total magnetic intensity. The spinning protons behave as small spinning magnetic dipoles which are temporarily aligned or polarized by the application of a strong current going through the magnetometer's sensor coil. When the current is removed the protons precess in response to the earth's magnetic field generating a signal that is directly proportional to the intensity of the total magnetic field and provides information on the orientation of the field.

The orientation of the field is important in terms of its polarizing effect on metallic bodies and the distribution of the magnetic anomaly. By developing information on the direction of the earth's field and the profile of the magnetic anomaly at a given point in time, it is possible to estimate the size, shape, and depth of buried metallic objects such as drums.

A metal drum behaves as a dipole in the earth's field with the negative induced pole in the south or up direction and the positive in the north or down direction. Vertical polarization is predominant and the anomalies due to the drums usually will exhibit positive regions associated with negative regions.

Any magnetic field associated with a buried source is superimposed on the ambient field. The resultant field observed at the surface is referred to as the total field. Its interpretation can be complex since it requires a reduction of the total field into individual components of ambient field and local magnetic features.

Instrumentation

The E G & G Geometrics Model G-856 Proton Precession Magnetometer is a high precision instrument that measures the total magnetic field to a resolution of 0.1 gamma. The operation of this unit is controlled by a microprocessor which features simple operation and a solid state memory that can store 1,000 separate readings, including time, date and sequential station number. The microprocessor allows adjustment of instrument operation to make it more reliable and accurate.

This model requires tuning to achieve the best signal strength for a given area. This procedure matches the circuit's response to the intensity of the actual field measurement. Once the unit is manually adjusted, the microprocessor internally fine tunes the magnetometer to achieve peak signal capacity.

Field Investigation

At the start of the survey a site will be selected outside the area of interest at which magnetic background measurements will be taken. This location will be selected on the basis of both convenience and remoteness from observed magnetic anomalous zones, such as rails,undergound utilitis or overhead lines. Magnetic readings will be made hourly at the same location during the course of the survey to keep a record of the diurnal variation in the earth's magnetic field.

The first activity (approximately 1-2 days) will be to establish a ground coordinate system in which each measurement station will be determined. The grid will be based on measurement locations spaced 20-feet apart ; where magnetic anomalies are detected, the measurement spacings may be reduced to 5 or 10-feet depending upon the specific needs of the project.

The coordinate system will be marked by wooden stakes or aluminum spikes in a manner that will allow areas of magnetic disturbances to be delineated once the survey has been completed.

Data Analysis

The magnetic measurement data will be compiled into tabular form listing the location and value for each measurement. Diurnal variations will be evaluated and corrections for each data point will be made, where necessary. The background diurnal magnetic readings will be presented in a figure as a function of time. An iso-magnetic intensity map will be prepared with an appropriate contour interval for interpretive purposes.

Associated magnetic highs and lows, as well as unassociated magnetic highs and lows will be delineated. The data will be analyzed and presented in a text that interprets the results of the survey and illustrates the magnetic anamolies of the area.

APPENDIX F

PROCOTOLS FOR CONDUCTING AND REPORTING ON REMEDIAL INVESTIGATIONS, FEASIBILITY STUDIES, AND REMEDIAL ACTIONS

APPENDIX F

Protocols for Conducting and Reporting on Remedial Investigations, Feasibility Studies, and Remedial Actions

Remedial Investigations

Remedial investigations for the UOP Site will be conducted according to the attached Work Plan in a manner consistent with guidance provided by the EPA in its manual Guidance on Remedial Investigations Under CERCLA, EPA/540/G-85/002 (June 1985).

The central purpose of the remedial investigation is to collect, present and discuss all data necessary to adequately support the development of a feasibility study and the selection of a remedial action alternative that will remediate the adverse impacts of the pollution on human health and the environment. The investigation program described in this Work Plan is designed to supplement work performed during the Phase I and Phase II investigation. The results of these investigations are contained in Geraghty & Miller, Inc. reports of May 1984 (Phase I) and May 1985 (Phase II).

In addition to EPA guidelines and items included in the Work Plan, the following guidelines will be followed:

1. Soil and rock samples will be retained for geologic reference for a period up to two years.

2. Water samples will not be collected from monitoring wells during the 14 days after installation.

3. Sediment samples will be collected in accordance with Field Procedures Manual for Water Data Acquisition, Division of Water Resources, New Jersey Department of Environmental Protection, 1983.

4. Well casing, screens, and drilling equipment will be cleaned as follows:

   a. Manual scrubbing to remove foreign material.

   b. Steam cleaning inside and out until oil and grease are removed.

   c. Material will be stored to preserve its clean condition until use.

5. The remedial investigation report will include text, tables, and figures as required to fulfill the purpose of the remedial investigation as stated above.

FEASIBILITY STUDIES

Feasibility studies for the UOP site will be conducted in a manner consistent with guidance provided by the EPA in its Manual Guidance on Feasibility Studies under CERCLA, EPA/540/G-85/003 (June 1985).

In addition to this guidance and specifications included in the Work Plan, the following guidelines will be followed:

1. Feasibility Study Work Plan

   The Feasibility Study Work Plan will include the following:

   a. A list of potentially viable remedial action alternatives to be considered.

   b. A list of criteria (technical, environmental, institutional, and cost) to be applied during the feasibility study.

   c. Schedule of key interim dates of feasibility study.

2. Feasibility Study Report

   The Feasibility Study Report will include the following:

   a. Detailed discussion of initial screening of remedial action alternatives according to the approved FS Work Plan.

   b. Detailed description of remedial action alternatives that remain after initial screening according to the approved FS Work Plan.

c. Detailed evaluation and comparison of remedial action alternatives based on the descriptions presented pursuant to the approved FS Work Plan.

d. Recommendation of, rationale for, and conceptual design of the best remedial alternative, as per the criteria applied which are listed in the approved FS Work Plan.

e. Conceptual design of recommended remedial alternative.

f. List all references used in feasibility study.

REMEDIAL ACTIONS

The scope of work for remedial acitons will include the following:

1. Detailed Engineering Design

2. Schedule for construction, operations, and maintenance

3. Operations, maintenance, monitoring, and reporting requirements

4. Performance Evaluation

   a. During implementation of ground-water recovery aspects of any remedial alternative, the recovery system's radius of influence will be estimated. In addition, adequate performance evaluation monitoring will be conducted. Data will be presented in the following ways as appropriate:

      1. Data tables
      2. Ground-water quality contour map(s)
      3. Ground-water elevation contour map(s)
      4. Time/concentration graphs
      5. Pumping records for recovery systems

   b. Post-cleanup sampling will be performed, as appropriate, for soil, ground water, and sediment.

5. Detailed cost estimates will be provided.

decontamination provided that it is also deionized; use of this water is unacceptable for field and trip blanks unless it has been demonstrated to be analyte free by laboratory analyses.

IMPORTANT NOTE: Use of dedicated sampling equipment is recommended

III. CONTENTS OF REMEDIAL INVESTIGATION REPORT

A. Presentation of data

1. results of all analyses on data sheets supplied by the Department, laboratory data sheets and the required quality assurance documentation

2. summary table(s) of all analyses

3. stratigraphic logs including grain size and field instrument readings detected during drilling for each soil boring and monitor well

4. as-built construction diagrams for each soil boring and monitor well

5. well casing elevations to the nearest hundredth (0.01) foot above mean sea level, taken at the top of casing with

locking cap removed

6. depth to ground water to the nearest hundredth (0.01) foot above mean sea level, taken at the top of well casing prior to sampling with cap removal

7. all support data including graphs, equations, references, raw data, etc.

B. Maps

1. site map

   a. property boundaries

   b. structures and improvements

   c. surface water bodies

   d. site and adjacent land use

   e. topography indicating two foot contours

   f. all underground piping and utilities

   g. all underground tanks, associated piping, lagoons, seepage pits, dry wells, etc.

h. scale and orientation

2. sample location map(s)

a. monitor well locations and casing elevations

b. sample collection locations

c. soil boring locations

3. soil quality contour map and cross section(s)

4. ground-water elevation contour maps for each aquifer on multiple dates

5. ground-water quality contour map(s) and cross section(s)

6. ground-water flow contour maps shall be submitted taking into consideration tidal influences on groundwater and surface water. That is specific water level data shall be collected from representative wells during a period of high tide and low tide. Preferably this data should be collected within a 24 hour period. The map shall also include the time of day, date, observed tide and weather conditions. Tabulated summary of water level data shall also be submitted.

C. Discussion of data

1. waste characterization, including degree of hazard and probable quantities of waste, by type

2. description of site/regional hydrogeology and its relation to migration of pollutants

3. direction and rate of ground-water flow in the aquifer(s), both horizontally and vertically

4. levels of soil, surface water and ground-water pollution as compared to applicable standards pursuant to N.J.A.C. 7:14A-1 et seq., 7:9-5, 7:9-6, and guidelines, or background levels where pertinent

5. extent of soil, surface water and ground-water pollution both on and off site

6. pollutant behavior, stability, biological and chemical degradation, mobility and any other relevant factors pertinent to the investigation

7. projected rate(s) of pollution movement

8. identification of all pollution sources

9. identification of critical pollutants

D. Assessment of impact of pollution on human health and the environment

1. identification of human receptors in the paths of pollution migration; mobility of pollutants and specific routes to target organs (e.g., liver)

2. identification of the receiving media and/or ecological groups and migration pathways of critical pollutants

3. toxicology of each critical pollutant (acute and chronic toxicity for short and long-term exposure, carcinogenicity, mutagenicity, teratogenicity, synergistic and/or antagonistic associations, aquatic toxicity, ecological impacts on flora and fauna, etc.)

4. migration potential and environmental fate of each critical pollutant in site-specific terms (e.g., attenuation, dispersion and biodegradation are factors in the ground-water pathway)

5. evaluation of potential for biomagnification and/or bioaccumulation of critical pollutants in the food chain

E. Recommendations for additional investigations

1. waste

2. soil

3. ground water

4. surface water and sediment

5. air

From ACO Appendix D, pages D-36 to D-42

FEASIBILITY STUDY SCOPE OF WORK

I. REQUIREMENTS OF FEASIBILITY STUDY

A. Identify and list all potentially viable remedial action alternatives for the pollution at and/or emanating from the site

B. Develop alternatives to incorporate remedial technologies into a comprehensive, site-specific approach

C. Evaluate and compare remedial action alternatives

D. Recommend the most environmentally sound remedial action alternative which will, in a timely manner:

1. cleanup pollution at and/or emanating from the site

2. achieve and maintain applicable surface-water and groundwater quality standards pursuant to N.J.A.C. 7:14A-1 et seq., 7:9-5, 7:9-6, and guidelines established by the Department

3. return area to background conditions

4. effectively remediate damage to and provide adequate protection of human health and the environment

II. CONTENTS OF FEASIBILITY STUDY WORK PLAN

A. A statement of the requirements for the feasibility study pursuant to Section I., above

B. A detailed schedule for all feasibility study activities including

1. schedule of key interim dates in feasibility study

2. dates for submission of all permit applications required for completion of feasibility study

3. date for submitting feasibility study report to the Department

C. A list of all potentially viable remedial action alternatives to be considered

D. A presentation of initial screening procedures in accordance with the following:

1. screen all potentially viable remedial action alternatives to narrow the list of potential alternatives for further detailed analysis

2. initial screening criteria

   a. environmental and human health impacts

   b. engineering feasibility and reliability

3. all alternatives capable of remediating the environmental and human health concerns at and/or emanating from the site shall be retained

E. A presentation of characteristics to be used to describe remedial action alternatives remaining after initial screening in accordance with the following:

1. describe appropriate treatment and disposal technologies, as well as any permanent facilities required

2. specify engineering considerations required to implement the alternative (e.g., treatability study, pilot treatment facility, additional studies needed to proceed with final remedial design)

3. describe environmental and human health impacts and propose methods for mitigating or eliminating any adverse impacts

4. describe operation and maintenance/monitoring requirements of the completed remedy

5. describe off site disposal needs and transportation plans

6. describe temporary storage requirements

7. describe requirements for health and safety plans during remedial implementation (including both on site and off site health and safety considerations)

8. describe how the alternative could be phased into individual operable units, including how various components of the remedy could be implemented individually or in groups resulting in a functional phase of the overall remedy

9. describe how the alternative could be segmented into areas to allow implementation of differing phases of the alternative

10. describe how alternatives could be combined to create more effective alternatives

11. describe which Federal, State and local permits would be necessary for each alternative identified and outline the information necessary for the development of each of the permit applications

12. describe the time required for implementation, including significant interim dates

F. A detailed discussion of procedures to evaluate and compare the remedial action alternatives that remain after the initial screening in accordance with the following:

1. evaluate each alternative in accordance with the requirements referenced in I. D., above, and the following characteristics:

i. level of cleanup achievable

ii. time to achieve cleanup

iii. feasibility

iv. implementability

v. reliability

vi. ability to minimize adverse impacts during action

vii. ability to minimize off site impacts caused by action

viii. useability of ground water after implementation of alternative

ix. useability of surface water after implementation of alternative

x. useability of site after implementation of alternative

xi. legal constraints

2. compare each alternative in accordance with the requirements and characteristics identified in II. F. 1. above

G. Presentation of procedure concerning recommendation of remedial action alternative in accordance with the following:

1. based on the detailed evaluation process, recommend the most environmentally sound remedial action alternative which will, in the most timely manner, meet the requirements in I. D. above

2. prepare a detailed rationale for recommending the remedial action alternative, stating the advantages over other alternatives considered

3. prepare a conceptual design of the recommended alternative including:

   a. engineering and hydrogeologic approaches

   b. implementation schedules

   c. any special implementation requirements

   d. applicable design criteria

   e. preliminary site layout(s)

   f. operation and maintenance requirements

   g. safety plan(s)

III. CONTENT OF FEASIBILITY STUDY REPORT

A. Detailed discussion of initial screening of remedial action alternatives according to the approved FS Work Plan

B. Detailed description of remedial action alternatives that remain after initial screening according to the approved FS Work Plan

C. Detailed evaluation and comparison of remedial action alternatives based on the descriptions presented pursuant to the approved FS Work Plan

D. Recommendation of, rationale for, and conceptual design of most environmentally sound remedial alternative which meets the requirements in Section I. D., above, in the most timely manner and according to the approved FS Work Plan

E. Conceptual design of recommended remedial alternative

F. List all references used in feasibility study

REMEDIAL ACTION SCOPE OF WORK

I. Detailed Engineering Design

II. Schedule for Construction, Operation and Maintenance

III. Operation, Maintenance, Monitoring and Reporting Requirements

IV. Performance Evaluation

A. The selected remedial action alternative shall meet or exceed the requirements in Appendix E, item I.D., above

B. Procedure

1. during implementation of ground-water aspect of the alternative, the recovery wells' radius of influence shall adequately be recovering all polluted ground water

a. adequate performance evaluation monitoring

b. submission of monitoring data

i. ground-water quality contour map(s)

ii. ground-water elevation contour map(s)

APPENDIX G

RESUMES OF GERAGHTY & MILLER, INC.

AND ERT

SUPERVISORY PERSONNEL

DAVID W. MILLER

Principal

CREDENTIALS/REGISTRATION

M.S. Geology, Columbia University, 1953
B.A. Geology, Colby College, 1951
Registered Geologist: Arizona, California, Idaho, Delaware, Maine, Indiana, Virginia
Certified Professional Geologist: American Institute of Professional Geologists, Past President, Northeast Section
Certified Professional Hydrogeologist: American Institute of Hydrology, Member-Board of Review

PROFESSIONAL SOCIETY ACTIVITIES

National Water Well Association, Past Chairman-Technical Division, Member - Board of Directors
American Water Works Association, Past Chairman, Ground-water Committee
Technical Association of Pulp & Paper Industry, Past Chairman, Water Resources Committee
American Institute of Professional Geologists, Past President, Northeast Section

NATIONAL COMMITTEES

Member, Advisory Board - National Center for Ground Water Research - A consortium of University of Oklahoma, Oklahoma State University, and Rice University.
Member - Water Science and Technology Board - National Research Council, National Academy of Sciences and the National Academy of Engineering.
Member - National Groundwater Policy Forum - The Conservation Foundation and the National Governors Association.
Member - Ground Water Research Subcommittee - United States Environmental Protection Agency Science Advisory Board.
Past Member, Advisory Panel - Protecting the Nation's Ground Water From Contamination - Office of Technology Assessment, Congress of the United States.

AWARDS

National Water Well Association Technical Division, Science Award
New England Water Works Association, Dexter Brackett Memorial Medal

FIELDS OF SPECIALIZATION

- Organization of plans for development, management, and protection of ground water
- Organization and presentation of expert testimony
- Assessment of water resources availability
- Participation in programs to determine long-term impact of contamination of ground-water supplies
- National spokesman for the ground-water industry on ground-water issues

EXPERIENCE SUMMARY

Mr. Miller has carried out ground-water investigations throughout the United States and has served as a technical advisor on numerous water-supply and water-quality problems abroad. His work has involved development of ground-water resources for municipalities, private water companies, and industry. He has carried out water management studies for agencies at all levels of government and has investigated ground-water contamination incidents at industrial facilities, spill locations, and abandoned disposal sites in a wide variety of geologic environments. Mr. Miller's professional activities have required the development of an extensive knowledge of federal, state, and local programs related to ground-water quality protection and he has represented both the private sector and government at hearings, in litigation proceedings, and at public meetings. In addition, Mr. Miller has created an ongoing series of national seminars designed to provide training in ground-water management for industrial engineers, regulatory personnel, and environmental consultants.

KEY PROJECTS

- Special lecturer for the Chemical Manufacturers's Association (in addition to Petroleum, Aluminum, Steel and Paper industrial organizations) on industry response to ground-water protection requirements under SDWA, RCRA, and CERCLA. Presentations given to several thousand corporate representatives.

- Supervises exploration for and development of numerous large-scale ground-water supplies for major municipalities across the country.

- Participates in hundreds of investigations of industrial ground-water contamination incidents related to hydrocarbon and chemical discharges.

- Directs the development and implementation of remedial action plans.

- Advises and represents industrial generator groups in major superfund litigation.

- Inventoried and prioritized ground-water contamination problems in 26 states for USEPA Kerr Laboratory, Ada, Oklahoma.

- Directed nationwide compilation of data and prepared The Report to Congress, Waste Disposal Practices and Their Effects on Ground Water (USEPA, January 1977).

- Directed for USEPA the first national assessment of the importance of land disposal of hazardous waste as a threat to ground-water quality.

- Created the ground-water portion of the New Jersey Water Plan, providing the state with a long-term program for development, management, and protection of the resource.

- Developed a ground-water management plan for the state of Delaware.

KEY PROJECTS (Cont'd.)

- Served as ground-water policy manager on the $5.2 million Long Island 208 Study under contract to the Nassau-Suffolk Regional Planning Board.

- Prepared ground-water resource assessments for industry and governmental agencies in Thailand, Honduras, Jamaica, Bangladesh, and Mexico.

SELECTED PUBLICATIONS

Water Atlas of the United States, Library of Congress Catalog Card No. 63-11, Water Information Center, Inc., 1963.

Development of Ground Water in the Greater New York Metropolitan Area, American Society of Sanitary Engineering Bulletin, November-December 1967, January 1968.

Hydrologic and Geologic Principles of Land Disposal of Wastes, Water Pollution Control Federation, 1972.

Ground-Water Contamination in the Northeast States, USEPA, Environmental Protection Technology Series, June 1974.

Ground-Water Zoning - Fact or Fiction, National Water Well Association, Ground Water, 1978.

Planning of Site Investigations, California Manufacturers Association, 1980.

Principles of Ground-Water Management, National Water Quality Symposium, 1980.

Geohydrological Surveys at Chemical Disposal Sites, Proceedings of the Rockefeller University Symposium, Assessment of Health Effects at Chemical Disposal Sites, June 1-2, 1981, New York City.

Protection of Ground-Water Quality, Proceedings of the AAAS Symposium, Ground-Water Pollution, An Emerging Threat to a Natural Resource, January 3-8, 1982, Washington, D.C.

Cleanup and Containment of Ground-Water Contamination Incidents, Testimony before the Toxic Substances and Environmental Oversight Subcommittee, U.S. Senate, Washington, D.C., 1982.

Introduction to Ground-Water, Pollution Equipment News, October, 1983.

Principles and Framework of Ground-Water Hydrology, Proceedings of the Cornell University NE Water Management Conference, Ithaca, New York, 1983.

Sources of Groundwater Pollution, EPA Journal, Vol. 10, No. 6, July-August 1984.

MICHAEL F. WOLFERT

Associate
Member of the firm since 1971

CREDENTIALS/REGISTRATION

B.A. Geology--Hofstra University 1971
Certified Professional Geologist: American Institute of Professional Geologists

PROFESSIONAL AFFILIATIONS

National Water Well Association
Geological Society of America

FIELDS OF SPECIALIZATION

- Management of large-scale projects concerning ground-water contamination and ground-water resource development
- Supervision of complex aquifer testing programs
- Development and evaluation of hydrogeological data

EXPERIENCE SUMMARY

While at Hofstra University Mr. Wolfert received the Sydney A. Mayor Award for excellence in geology. He has been involved in ground-water resources exploration, development, and management studies since joining Geraghty & Miller, Inc. Mr. Wolfert has investigated ground-water contamination caused by hydrocarbon spills, the subsurface leakage of phosphorus, and a wide variety of industrial solvents. He has evaluated the data developed during large-scale drilling and testing operations and he has supervised many complex pumping tests.

KEY PROJECTS

- Determined extent of ground-water contamination caused by a hydrocarbon spill at a major airport in Florida. Also assisted in development of an abatement program.

- Supervised construction and testing of 11 large-diameter test wells to evaluate ground-water potential of a large tract of land in New Jersey as a site for a liquified natural gas plant.

- Designed and implemented a ground-water sampling program to determine the feasibility of developing a 10,000 gpm water supply for a proposed crude oil gasification plant in North Carolina.

- Developed a ground-water supply study for a new township in southern New Jersey. The study determined the effect of the proposed development on other major ground-water users in the region.

- Supervised the exploration and development of a 100,000 gpd ground-water supply for industrial purposes in New York.

- Planned a ground-water exploration project along the Mississippi River in Missouri to determine the availability of water to serve a large industrial plant.

KEY PROJECTS (Continued)

- Provided detailed description of geology and ground-water system of Middlesex County, New Jersey for county's 208 study.

- Designed field and analytical program to determine movement and extent of subsurface leak of phosphorus at an industrial site in New Jersey.

- Supervised large-scale drilling program to gather data for computer model of segment of North Fork of Long Island as part of an investigation of potential impact of proposed nuclear power plant.

- Responsible for data analysis from large-scale drilling program designed to determine extent and severity of ground-water contamination at large industrial site in New Jersey.

- Planned and managed test drilling program in Massachusetts to develop additional 1 mgd ground-water supply for municipality in Massachusetts.

- Planned and managed large-scale test drilling program to collect hydrogeologic data for U.S. Geological Survey computer model of portion of Suffolk County, New York.

- Provided technical assistance to USEPA concerning its investigation of ground-water contamination problem in Iowa.

- Prepared detailed description of geology and hydrology of the New Jersey Pine Barrens region as part of planning effort for the area.

- Developed and supervised test drilling program to determine extent, severity, and source of ground-water contaminated with organic compounds at an industrial site in Connecticut.

ROBERT A. SAAR, Ph.D.

Senior Scientist
Member of the firm since 1981

CREDENTIALS/REGISTRATION

Ph.D. Soil & Natural Water Chemistry, University of New Hampshire 1980
B.A. Chemistry, Yale University 1973
Certified Professional Geologist: American Institute of Professional Geologists (Cert. No. 6815)

PROFESSIONAL AFFILIATIONS

American Chemical Society
American Geophysical Union
Geochemical Society
New York Academy of Sciences

FIELDS OF SPECIALIZATION

- Determination of the nature and extent of subsurface chemical contamination
- Development of field techniques and quality assurance programs for water quality sampling
- Trace metal complexation by soil organic matter
- Development of methods for evaluating water quality data and assessing laboratory performance
- Public presentation and meetings (both technical and non-technical)

EXPERIENCE SUMMARY

Dr. Saar is responsible for the evaluation of chemical data obtained in studies of ground-water quality. He establishes and supervises protocols for the sampling and analysis of ground-water and geologic samples. He has had considerable experience with ground-water monitoring projects, many of which were in response to state and Federal (RCRA, Superfund) hazardous waste regulations or compliance orders.

Dr. Saar supervised the development of a Geraghty & Miller, Inc. field sampling service which included the training of field personnel and the development of quality assurance protocols. He is responsible for maintaining this program. Dr. Saar also manages a number of projects involving evaluation of ground-water contamination, for which he has designed and carried out programs for sampling and tracing ground-water contaminants from their points of origin. He has prepared and delivered numerous lectures and training programs on contamination assessment and ground-water monitoring for industrial and regulatory groups.

KEY PROJECTS

- Assisted in the development of a subsurface contamination mapping project and ground-water model for a major New Jersey chemical firm.

- Prepared geochemical section of modeling study to determine the migration of methanol in ground water.

- Investigated ground-water chemistry and potential significance of contaminant migration in the vicinity of the Ocean County and Jackson Township Landfills in New Jersey.

KEY PROJECTS (Continued)

- Prepared a lecture series on ground-water chemistry for presentation to the mining group of a major oil company.

- Managed a major investigation of the source of organic contamination in a well field in Connecticut, which included extensive quality-control measures to assure the reliability of the conclusions.

- Manager for the subsurface investigation (both saturated and unsaturated zones) of natural gas under a housing development in New Jersey.

- Assessed the long-term effects of leachate on the quality of ground water near the Babylon, New York, landfill.

- Prepared RCRA compliance documents for a ground-water assessment program for a New Jersey chemical firm.

- Evaluated contamination potential and nature of hazards associated with Department of Energy disposal areas, Oak Ridge, Tennessee.

- Provided technical guidance to New Jersey firms related to compliance with Environmental Cleanup Responsibility Act (ECRA).

- Project Manager for Superfund Cleanup sites, with responsibility for interpretation of physical and chemical data, and for all documentation and liaison with the regulator.

- Completed technical support projects for the USEPA:
  1. A Comparison of Chemical Attenuation Processes in Saturated and Unsaturated Fine-Grained Materials (1982).
  2. Evaluation of EPA Appendix VIII Monitoring Requirements (1983).
  3. Statistical Comparison of Ground-Water Monitoring Data (1984).
  4. Guidance Manual for the Selection of Chemical Parameters at Hazardous Waste Facilities (1985)

SELECTED PUBLICATIONS

Co-author of text A Study Guide to Accompany Chemistry, The Universal Science published by Addison-Wesley, Reading, Massachusetts, 1979.

Saar, R.A., and J.H. Weber, "Complexation of cadmium (11) with water- and soil-derived fulvic acids: effect of pH and fulvic acid concentration." Canadian Journal of Chemistry, 57, 1963-1268 (1979).

Saar, R.A., and J.H. Weber, "Lead (11) complexation by fulvic acid; How it differs from copper (11) - and cadmium (11) - fulvate complexation," Geochimica et Cosmochimica Acta 44, 1381-84 (1980).

Saar, R.A., and J.H. Weber, "Comparison of spectrofluorometry and ion-selective electrode potentiometry for determination of complexes between fulvic acid and heavy metal ions," Analytical Chemistry 52, 2095-2100 (1980).

SELECTED PUBLICATIONS (Cont'd.)

Saar, R.A., and O.C. Braids, "Groundwater," Jour. Water Pollution Control Federation, 53, 921-925 (1981).

Saar, R.A., and J.H. Weber, "Fulvic acid: modifier of metal-ion chemistry," Environmental Science & Technology, 16, 510A-517A (1982).

Saar, R.A., and O.C. Braids, "Chemical indicators of leachate contamination in ground water near municipal landfills," in Environmental and Solid Wastes: Characterization, Treatment, and Disposal (Proceedings of the Fourth Oak Ridge National Laboratory Life Sciences Symposium, Gatlinburg, Tennessee, October 4-8, 1981), Ann Arbor Science Publishers, Ann Arbor, Michigan, 1983, pp. 315-328.

Saar, R.A., "Problems in Assessing Organics Contamination in Ground Water," in Management of Toxic and Hazardous Wastes (Proceedings of the Third Ohio Environmental Engineering Conference (ASCE), Columbus, March 1983), Lewis Publishers, Chelsea, Michigan, 1985.

Saar, R.A., and G.M. Spreizer, Guidance Manual for the Selection of Chemical Parameters at Hazardous-Waste Facilities, Draft, prepared for the Land Disposal Branch, Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C., 1985.

WILLIAM A. DUVEL, JR.

PROFESSIONAL HISTORY

ERT, 1978 to present
Michael Baker, Jr. Inc. 1973 to 1978
University of Pittsburgh, 1969 to 1973

EDUCATION

PhD. (Environmental Sciences) Rutgers University
M.S. (Environmental Sciences) Rutgers University
B.S. (Biology) Tufts University

AFFILIATIONS

American Society of Civil Engineers
American Water Resources Association
New England Water Pollution Control Association
Water Pollution Control Federation

PROFESSIONAL REGISTRATION

P.E. (Sanitary Engineering) Pennsylvania, Massachusetts, New Jersey, Texas, Connecticut

TECHNICAL SPECIALTIES

- Industrial property evaluation
- Hazardous waste management
- Hazardous waste site/risk assessment
- Fly ash and FGD sludge management

REPRESENTATIVE PROJECT EXPERIENCE

Superfund Sites

- Ottati and Goss Site, Kingston, NH. Provided expert witness testimony on behalf of Geochem, a defendant in litigation brought by U.S. Department of Justice and U.S. EPA.

- Re-Solve, Inc. Site, North Dartmouth, MA. Provided technical review and critique of government RI/FS for PRP committee.

- Pacific Hide and Fur, Pocatello, ID. Provided technical review of government work and recommendations for technical studies for site owner.

- Groveland Wells Site, Groveland, MA. Program Manager for complete RI/FS for EPA funded program.

- Dover Landfill, Dover, NH. Risk/Endangerment assessment for government sponsored RI/FS.

1534J-0120

- Somersworth Landfill, Somersworth, NH. Risk/Endangerment assessment for government sponsored RI/FS.

- Seaboard Site, Kearny, NJ. Technical consulting to Koppers Co. (PRP) on nature and extent of RI studies.

- Industriplex Site, Woburn, MA. Technical comment on RI/FS and development of alternative cleanup strategies for Monsanto (PRP).

Hazardous Waste Site Investigation/Remedial Action

- Allied/Signal - Chrome Residue Site - Managed technical studies to evaluate nature of problem and clean-up scenarios at 35-acre chromium ore residue site in New Jersey.

- AT&T - Kearny Works ECRA Clean-up - Managed complete ECRA evaluation and clean-up of 150-acre site in Kearny, NJ.

- AMCA International - Site Clean-up - Evaluation and clean-up of fastener manufacturing site in New Bedford, MA as part of MGL 21E program.

- Fastener Manufacturer - Site Clean-up - Developed site evaluation program and remedial action plan for contaminated soil at screw manufacturing firm in Somerville, MA.

- Starrett City, Inc. - Landfill Evaluation. Regulatory compliance and health risk assessment for the Fountain Avenue (350 acres) and Pennsylvania Avenue (100 acres) Landfills in Brooklyn, New York.

- Petrochemical Co. - Site Evaluations. Developed guidelines to evaluate the health/environmental hazards at the company's existing waste disposal sites nationwide.

- Neville Land Company - Disposal Site Remediation. Project manager for site assessment and remedial action program for site near Pittsburgh, formerly used for disposal of pesticide residues, various solvents, slag, and other residues.

Property Survey and Evaluation

- Investment Banker Group - Asset Evaluation. Managed program to evaluate assets of bankrupt firm with six manufacturing facilities in WA, IL, MT, PA, and WI.

- Ryan, Elliott & Co., Inc. - Site Evaluation. MGL 2IE evaluation of the 15-acre King Terminal property, So. Boston, MA.

- Boston Company - Commercial Real Estate Evaluation. Technical coordinator for evaluation of 15 commercial development projects across the country.

- o Manufacturing Firm - Site Evaluation. Investigation of potential soil contamination at manufacturing facility making lead-based products in MA.

- o Property Survey and Evaluation: Technical advisor on approximately 10 studies to investigate potential soil, ground-water, and surface water contamination at sites in New York, Massachusetts, Connecticut, New Jersey, Ohio, and North Carolina.

- o Environmental Risk Assessment Services, Inc., EIL Insurance Inspections: Conducted site audit/survey and risk assessment of a Turnpike Authority, multidivisional consumer oriented manufacturing company, and municipal entity for environmental impairment liability insurance.

Environmental Audits

- o Allis chalmers - Waste Disposal Contract Evaluation - Conducted audit and evaluation of prospective commercial land disposal and incineration sites for industrial process residues in IL and MO.

- o Prepurchase Environmental Compliance Assessments - Completed assessments at these locations and facilities:

  -Turbine manufacturing facility in MA
  -Paint factory in MA
  -Ceramic tile manufacturing plant in PA
  -Two chemical plants in OH and PA
  -Asphalt plant in KS
  -Wire fence manufacturing plants in TX
  -Specialty steel mills in OH and PA
  -Carbon black plant in TX.

- o Pharmaceutical Plant - Environmental Compliance Assessment - Provided technical direction for an environmental compliance asssessment of a pharmaceutical plant and research facility in CT.

Process Waste Management

- o Conrail - Coal Pile Runoff Investigation - Project manager for engineering study and design of abatement facilities for coal pile runoff into Lake Erie from a 50-acre coal pile storage facility in Ashtabula, OH.

- o Kaiser Aluminum and Chemical Company - Spent Pot-liner Disposal Practices - Provided technical consulting to assess existing hazardous waste disposal operations, to evaluate remedial measures for a 2-acre storage facility, and to develop a new facility to control cyanide leachate from disposal of spent pot-liners used in aluminum refining at Spokane, WA.

- Electric Power Research Institute - Mine Disposal of FGD Sludges - Project manager for a program to evaluate the state-of-the-art of mine disposal of utility solid wastes and to examine the effect of SMCRA regulations on mine disposal potential.

- Penn Central Transporation Company - Solid Waste Management Plan - Provide an assessment of environmental non-compliance activities and a feasibility study for upgrading two waste incinerators (200 tons per week) at rail car reclamation facilities in Altoona and Holidaysburg, PA.

- Royal Commission for Jubail and Yanbu, Saudi Arabia - Hazardous Waste Management Plan - Project Manager for developing hazardous waste inventory and hazardous waste management plan for Jubail Industrial City, Saudi Arabia.

- Electric Power Research Institute - FGD Sludge Disposal - Project manager for a study evaluating the state-of-the-art of FGD sludge fixation. The study resulted in an engineering manual for the disposal of FGD sludges widely used by electric utilities.

- PA Department of Environmental Resources - FGD Sludge Disposal - Project manager for a program to evaluate the disposal of FGD sludges in abandoned deep coal mines.

Disposal Site Selection and Development

- St. Joe Minerals Corporation - Demolition Disposal Site - Conducted a site investigation and feasibility study for disposal of demolition rubble on 5-acre site in PA.

- St. Joe Minerals Corporation - FGD Sludge Disposal Site - Supervised a preliminary geological investigation to determine suitability of 285-acre site for disposal of 150 tpd of dual-alkali SO_2 scrubber residue and ash.

- St. Joe Minerals Corporation - Fly Ash Disposal Site - Identified, evaluated, and compared twelve candidate sites approximately 25 acres in size for the disposal of 100 tpd fly ash and bottom ash.

- Beaver County, PA - County Landfill Plan - Developed the operational plan, operational cost estimates, and permit application for development of county landfill on 50 acres of strip-mined land in PA.

RCRA Consulting

- Electronics Manufacturer - RCRA Training Program - Participated in the development and conduct of a RCRA training program for approximately 40 environmental managers and purchasing agents.

- CP Chemicals - RCRA Part B - Prepared RCRA Part B permit application (approved) for tank and drum storage fecility at chemical manufacuturing plant in NJ.

- Chemical Manufacturers Association - RCRA Evaluation - Project manager for engineering critique of portions of proposed RCRA regulations.

Water Quality/Wastewater Engineering

- International Paper - Water Quality Studies - Responsible for field studies of the impact of pulp and paper mill discharges (especially color impact) on receiving streams at mills in NY, AL, and LA.

- American Electric Power Service Corporation - Coal Mine Drainage - Project manager for engineering investigation of water quality impact of discharges of three coal companies in West Virginia.

- National Commission on Water Quality, Regional Wastewater Assessment Studies - Conducted studies in OH and WV to assess the adequacy and cost of wastewater treatment technologies anticipated to meet 1977 and 1983 goals of PL92-500.

- Pittsburgh District Corps of Engineers - Urban Studies Program - Program manager for mine drainage investigation, economic baseline study, and detailed mine drainage site study as part of Metro Wheeling, WV Urban Study in 950 square mile area.

- Minnesota Pollution Control Agency -Power Plant EIS - Project manager for portions of EIS of proposed expansion of Clay Boswell steam electric generating station in Cohasset, MN.

- Virginia Electric and Power Company - New Plant Site Evaluation - Program manager for study evaluating coal sources, alternative transloader sites, alternative coal transportation modes, and FGD scrubbing alternatives for a new power station in Virginia.

- St. Regis Paper Co. - Environmental Permitting - Technical Director for environmental permitting studies for proposed mill expansions in Minnesota, Maine, and New York.

- PA Fish Commission - Environmental Impact Assessment - Managed a project consisting of engineering, hydrology, geology, and aquatic ecology studies to evaluate the impact of channelization on six PA streams.

Publications and Presentations

Duvel, W.A. Jr., "Pre-Purchase and Pre-Divestiture Audits," presented at the Fall Technical Conference on Environmental Auditing, Middle Atlantic States Section APCA, New York, NY, November 15, 1984.

Duvel, W.A. Jr., "Health Risk Assessment of Air Emissions from a Landfill Receiving Hazardous Waste" presented at the Northeast Atlantic International Section APCA, Worcester, MA, April 14, 1983.

Duvel, W.A. Jr., "Statistical Interpretation of Ground-Water Monitoring Results," presented at ASTM International Symposium on Industrial and Hazardous Wastes, Philadelphia, PA, March 1983.

Duvel, W.A. Jr. "Practical Interpretation of Ground-Water Monitoring Results," presented at Third National Conference and Exhibition on Management of Uncontrolled Hazardous Waste Sites, Washington, D.C., November, 1982.

Duvel, W.A. Jr. "Environmental 'Termite' Inspections" presented at the Second Ohio Environmental Engineering Conference, Columbus, Ohio, March, 1982.

Duvel, W.A. Jr. "Landfilling" presented at the RCRA Techniques for Compliance Conference sponsored by McGraw-Hill, Houston, TX, July, 1980.

Duvel, W.A. Jr. and Gaines, S.E., "RCRA and Hazardous Waste Management Regulations," Pollution Engineering, 11, 12 (1979).

Duvel, W.A. Jr., "Solid Waste Disposal: Landfilling," Chemical Engineering, July 2, 1979.

Duvel, W.A. Jr., Golden, D.M., and Knight, R.G., "Sulfur Dioxide Scrubber Sludge - What Disposal Options are Still Available," presented at the 86th National AI Chem E Meeting, Houston, Texas, April, 1979.

Duvel, W.A. Jr., Rapp, J.R., Atwood, R.A., and Merritt, G.L., "Leachate from Disposal of FGD Sludges in Deep Mines," presented at the APCA Conference, Houston, Texas, June 30, 1978.

Duvel, W.A. Jr., McLaren, R.J., Knight, R.G., and Morasky, T.M., "State-of-the-Art of FGD SLudge Fixation," presented at the APCA Conference, Houston, Texas, June 30, 1978.

Duvel W.A. Jr., McLaren, R.J., and Knight, R.G., "Flue Gas Desulfurization Sludge Disposal," presented at the Symposium on Waste Disposal from Coal Power Plants Sponsored by IU Conversion Systems, Inc., Pittsburgh, Pennsylvania, June 21-22, 1978.

Duvel, W.A. Jr., and Helfgott, T., "Removal of Wastewater Organics by Reverse Osmosis," JWPCF, 47, 1 (1975).

Evans, R. J., and Duvel W.A. Jr., "Disposal of Solid Waste from Post Combustion Desulfurization," Pollution Engineering, 6, 10 (1974).

Duvel, W. A. Jr., "Technical Review and Critique," presented at the Symposium on Minimizing the Waste Discharges from Water Treatment Plants as the 77th National Meeting AICHE, Pittsburgh, Pennsylvania, June 5, 1974.

Duvel, W.A. Jr., and Joisher, A.P., "Economic Evaluation of Polluted Water Reclamation by Reverse Osmosis," Cost Effectiveness in Pollution Control, Fifth Annual Northeast Regional Anti-Pollution Conference, University of Rhode Island, July, 1972.

Duvel, W.A. Jr., Helfgott, T., and Genetelli, E.J., "Flux Loss in Reverse Osmosis Due to Dispersed Organics," Chemical Engineering Symposium Ser., Water-1971, 68, 250 (1972).

Duvel, W.A. Jr., and Rozzell, T.C., "Mercury Pollution in the Rivers of Southwestern Pennsylvania," presented at Pennsylvania Academy of Science Meeting, Pittsburgh, Pennsylvania, April, 1971.

Duvel, W.A. Jr., Helfgott, T., "Removal of Organics from Wastewaters by Reverse Osmosis," presented before the Division of Water, Air and Waste Chemistry, American Chemical Society, Chicago, Illinois, September 13-18, 1970.

Helfgott, T., Hunter, J.V. and Duvel, W.A. Jr., "Analytic and Process Classification of Wastewaters," Chemical Engineering Symposium Ser., Water-1970, 67, 388 (1971).

MICHAEL C. WORTHY

PROFESSIONAL HISTORY

Environmental Research and Technology, Inc., 1985 to present
Stone & Webster Engineering Corporation, 1980 to 1985

EDUCATION

M.S. (Civil Engineering) Ohio State University
B.S. (Civil Engineering) Ohio State University

PROFESSIONAL AFFILIATIONS

Registered Professional Civil Engineer, Massachusetts
Boston Society of Civil Engineers Section
American Society of Civil Engineers
American Geophysical Union

TECHNICAL SPECIALTIES

Surface-water hydrology, hydraulics, hazardous wastes investigations, coastal engineering, geotechnical engineering and numerical modeling.

REPRESENTATIVE PROJECT EXPERIENCE

- Industrial Clients: Investigated ground-water and soil contamination problems at various private industrial sites. Coordinated soil and water sampling field efforts. Advised clients involved in litigation. Characterized contamination sources and pathways. Helped clients negotiate with Federal and State Agencies.

- Federal Emergency Management Agency, Flood Insurance Administration: Responsible for the development of the wave runup computer program and wave envelope methodology applied nationally for flood insurance studies. Applied the methodology in thirty coastal communities in New England. Instructed on use of methodology at FEMA sponsored seminar.

- Confidential Client, Electric Power Station: Developed and applied numerical model for computing transient pressures and water surface elevations inside a structure that is hydraulically connected to external wave activity.

- Hydraulic and Hydrologic Analyses for Various Electric Power Stations: Wave force analyses, HEC-2 modeling, hydraulics studies, coastal sedimentation studies, coastal structure design, wave runup prediction and rainfall runoff analyses for design of electrical power stations. Hydrothermal dilution and dispersion modeling. Field reconnaissance and surveying for coastal wave impact studies.

- o Ohio Department of Natural Resources: In graduate research at The Ohio State University, supervised field team for coastal data collection effort. Field team measured beach profiles, collected sediment samples and surveyed river mouth plan form changes on Lake Erie. Analytical work consisted of determining beach and littoral processes, including wave hindcasting, bathymetry and wave measurements, and littoral drift calculations.

PUBLICATIONS

Bedford, K., Worthy M., Mattox, W., and Herdondorf, C., "Littoral Drift Processes at Estuary Mouths - A Case Study at Old Woman Creek in Lake Erie," OWRT Project Completion Report, October 1983, 197 pp.

Worthy, M.C. and Bedford, K.W., "Comparison of Lake Erie Littoral Drift Calculations," submitted to ASCE Journal of Waterway, Port, Coastal and Ocean Engineering.